United States Patent [19]

Behne

[11] **3,858,361**

[45] **Jan. 7, 1975**

[54] **RAIL GRINDING MACHINE**

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[73] Assignee: **Chemetron Corporation,** Chicago, Ill.

[22] Filed: **Jan. 17, 1974**

[21] Appl. No.: **434,201**

Related U.S. Application Data

[62] Division of Ser. No. 239,293, March 29, 1972, Pat. No. 3,818,650.

[52] **U.S. Cl.** ..... **51/80 R**

[51] **Int. Cl.** **B24b 1/00,** B24b 46/01, B24b 7/00

[58] **Field of Search** ..... 51/72 R, 80 R, 31, 32, 51/140, 178, 241 LG, 326, 327

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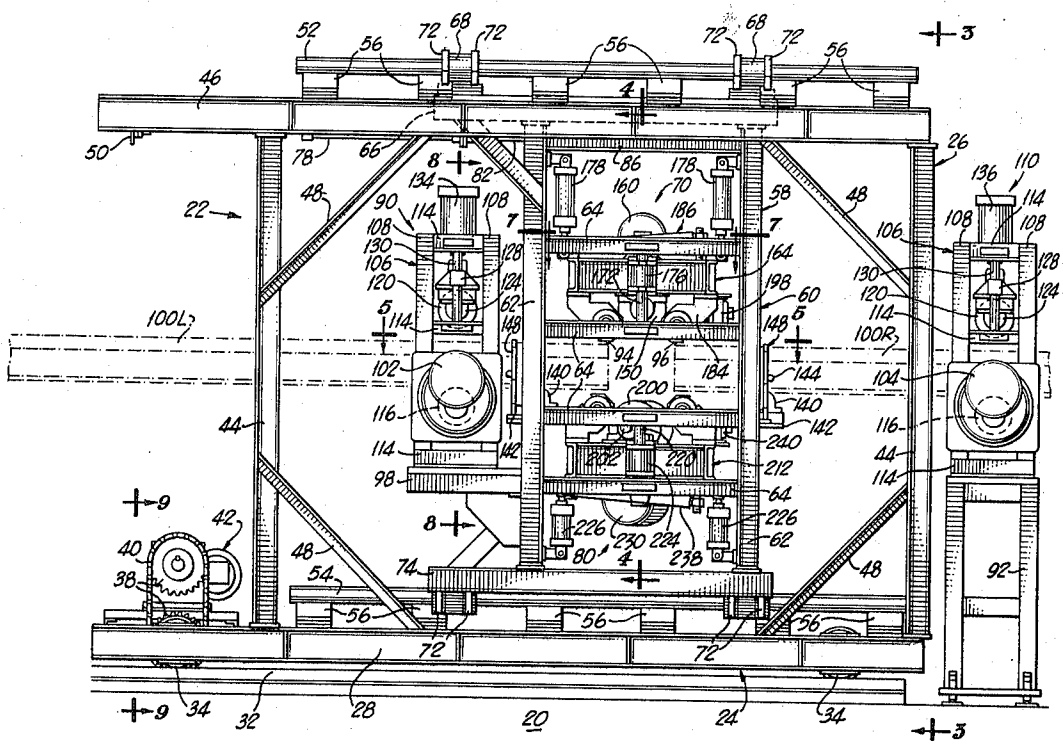
Primary Examiner—Othell M. Simpson

Attorney, Agent, or Firm—Mason, Kolehmainen, Rathburn & Wyss

[57] **ABSTRACT**

Apparatus for grinding surfaces adjacent the ends of a pair of rail sections to be welded together comprising means for holding the rail sections in end-to-end aligned, longitudinal relation, abrasive grinding means movable about an axis of rotation extending laterally of the rail sections and at an acute angle relative to the longitudinal axis thereof mounted on carriage means slidable longitudinally of the rail section, and pressure means for moving the abrasive member into contact with the surface of the rail sections during longitudinal travel by the carriage.

12 Claims, 17 Drawing Figures



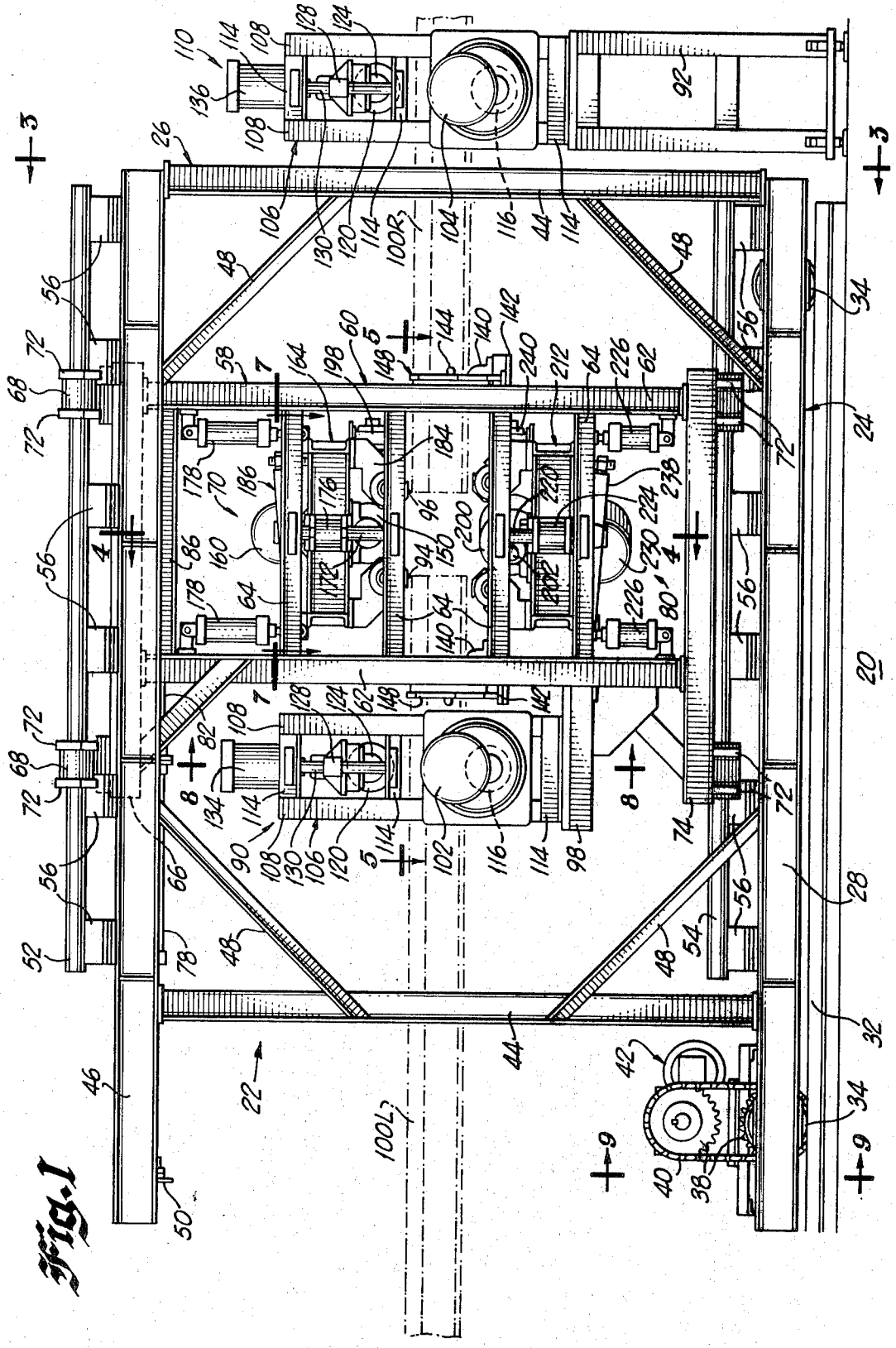


Fig. 1

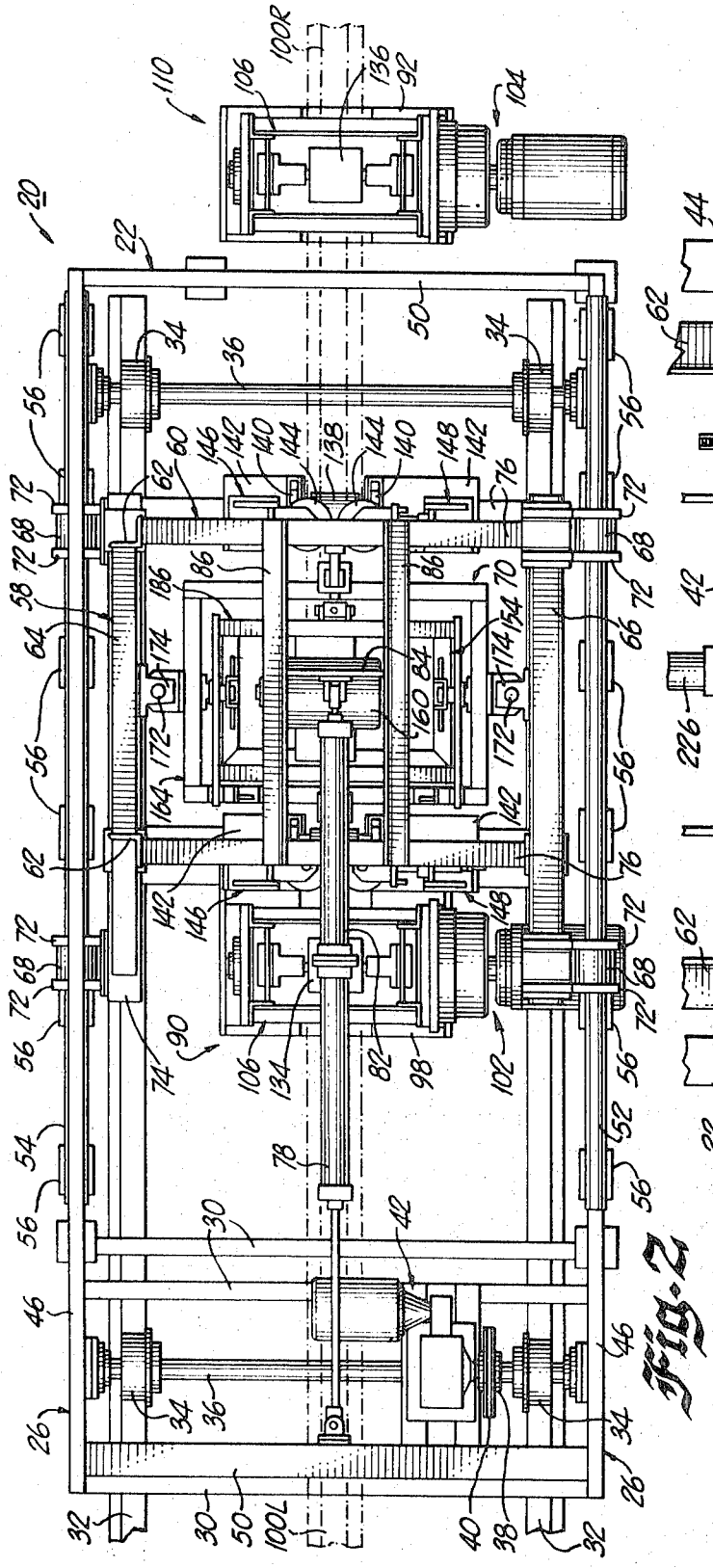


Fig. 2

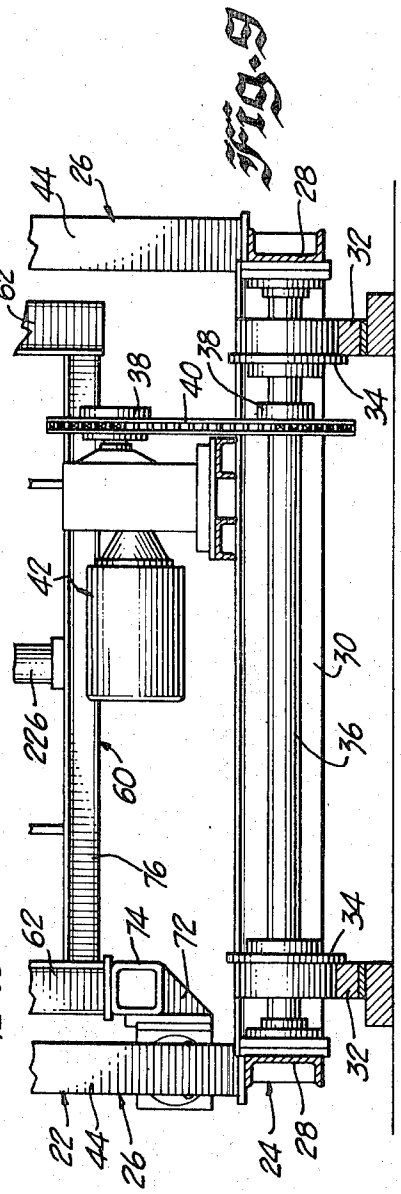


Fig. 3

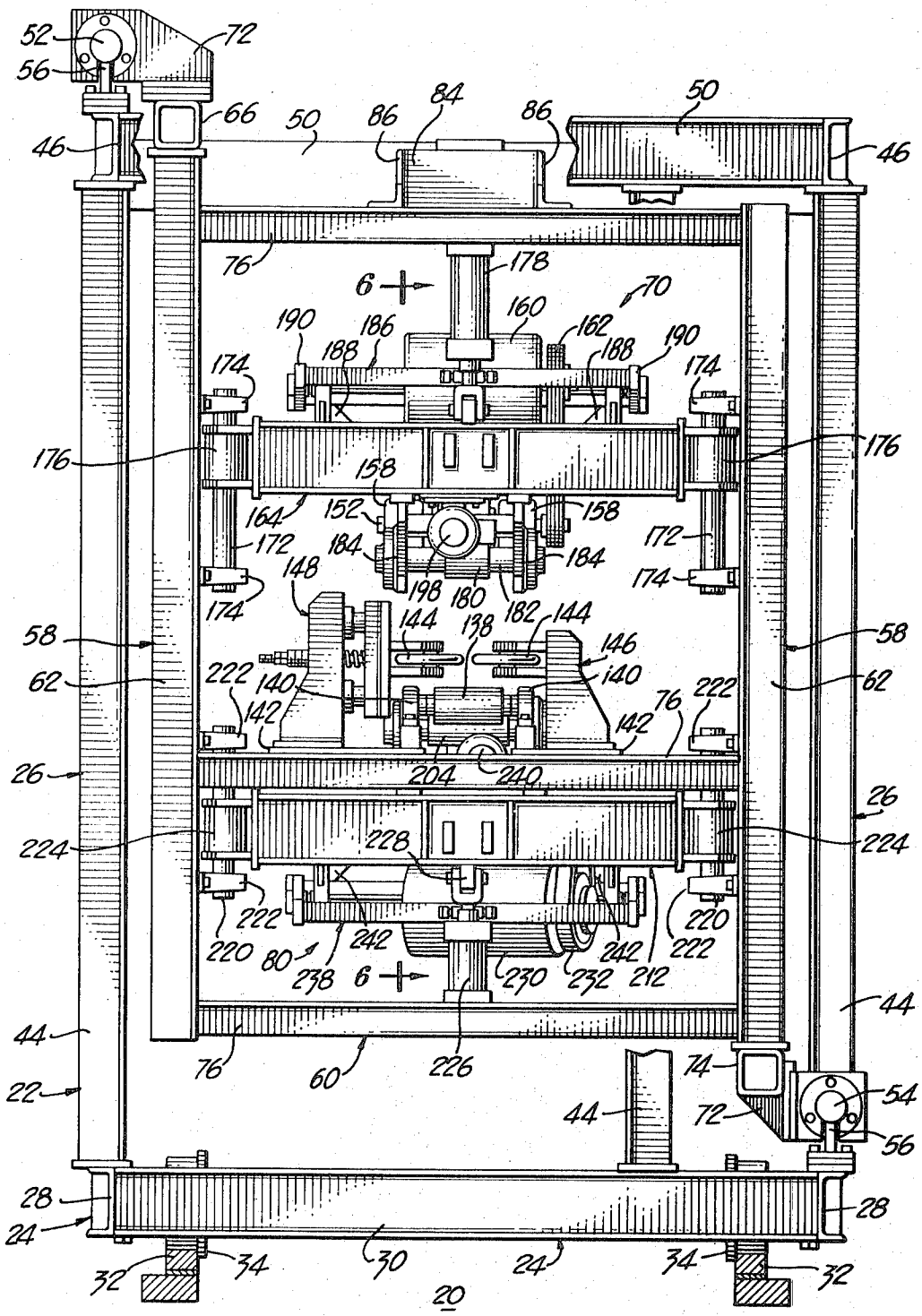

52
56
72
66
50
86
84
86
50
46
46
76
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6
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146
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62
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140
140
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142
142
76
222
26
204
240
26
224
224
228
222
222
220
220
242
242
80
238
6
230
232
212
44
44
76
60
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74
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72
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20

Fig. 3

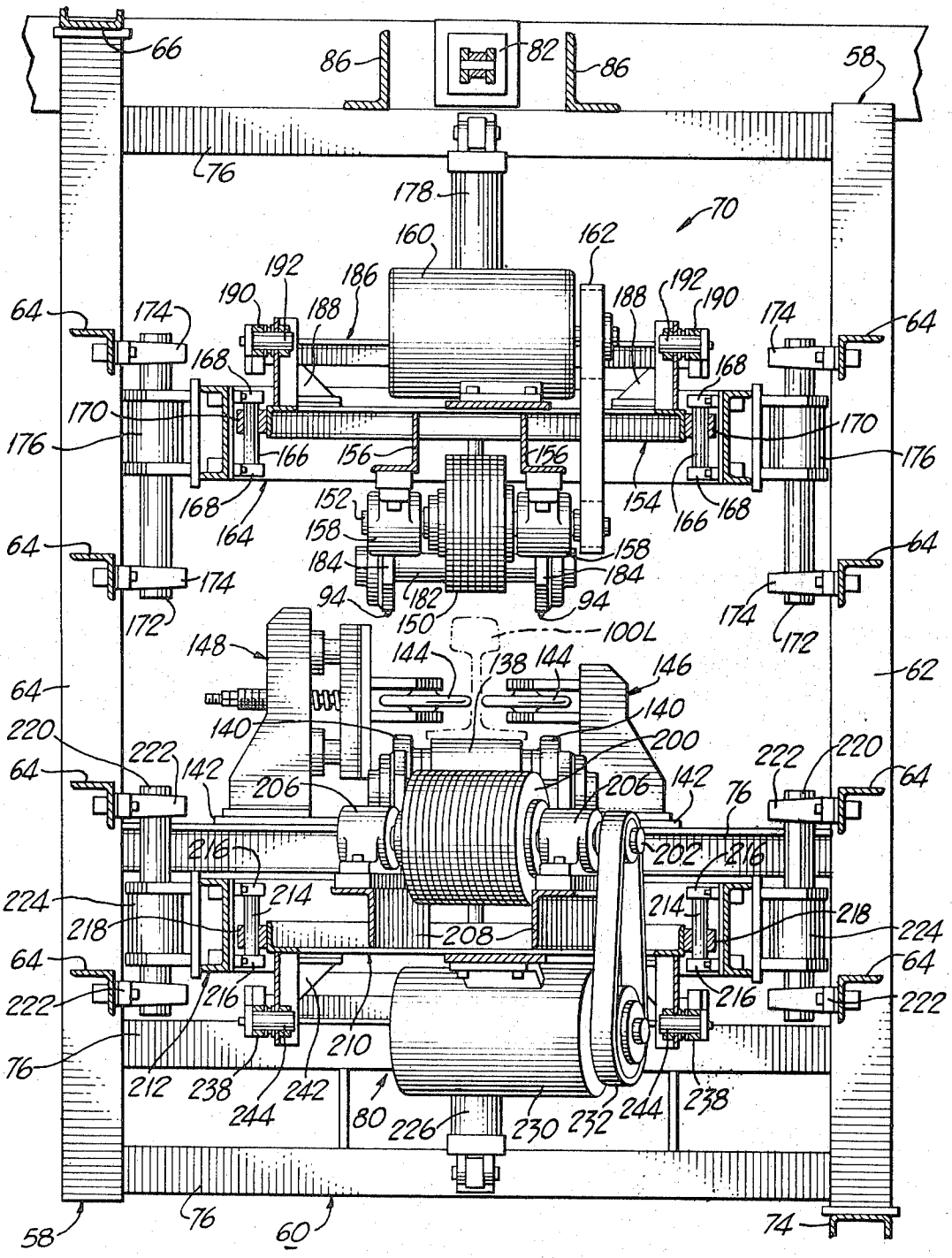

66
86
82
86
58
76
178
70
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162
192
186
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188
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64
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168
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154
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168
152
158
184
182
150
100L
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74
62

Fig. 4

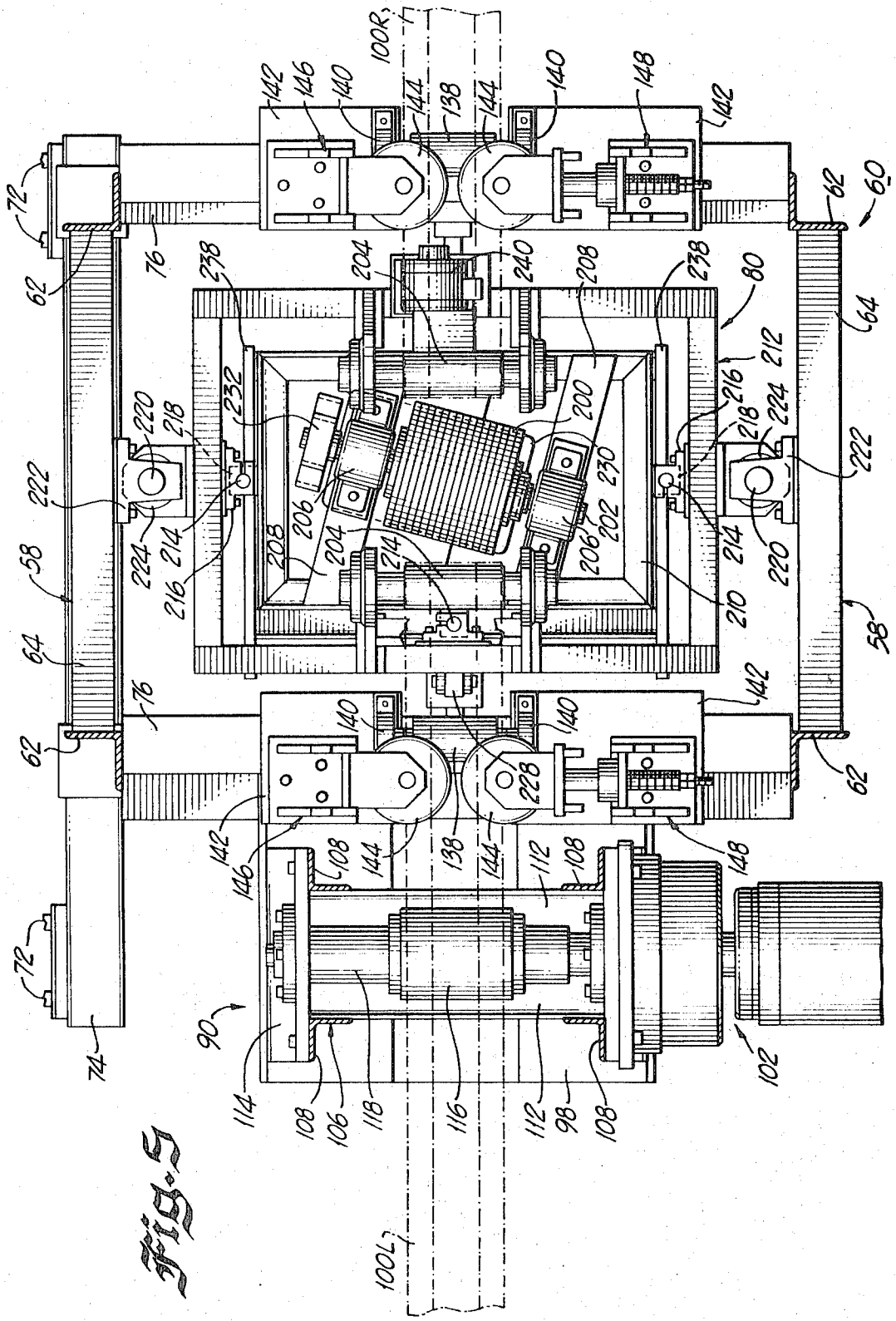

100R
142
146
140
144
138
148
72
62
60
76
238
204
240
208
80
64
212
216
224
218
232
220
222
200
230
206
202
214
210
58
228
108
112
90
74
102
114
106
118
116
98
100L

FIG. 5

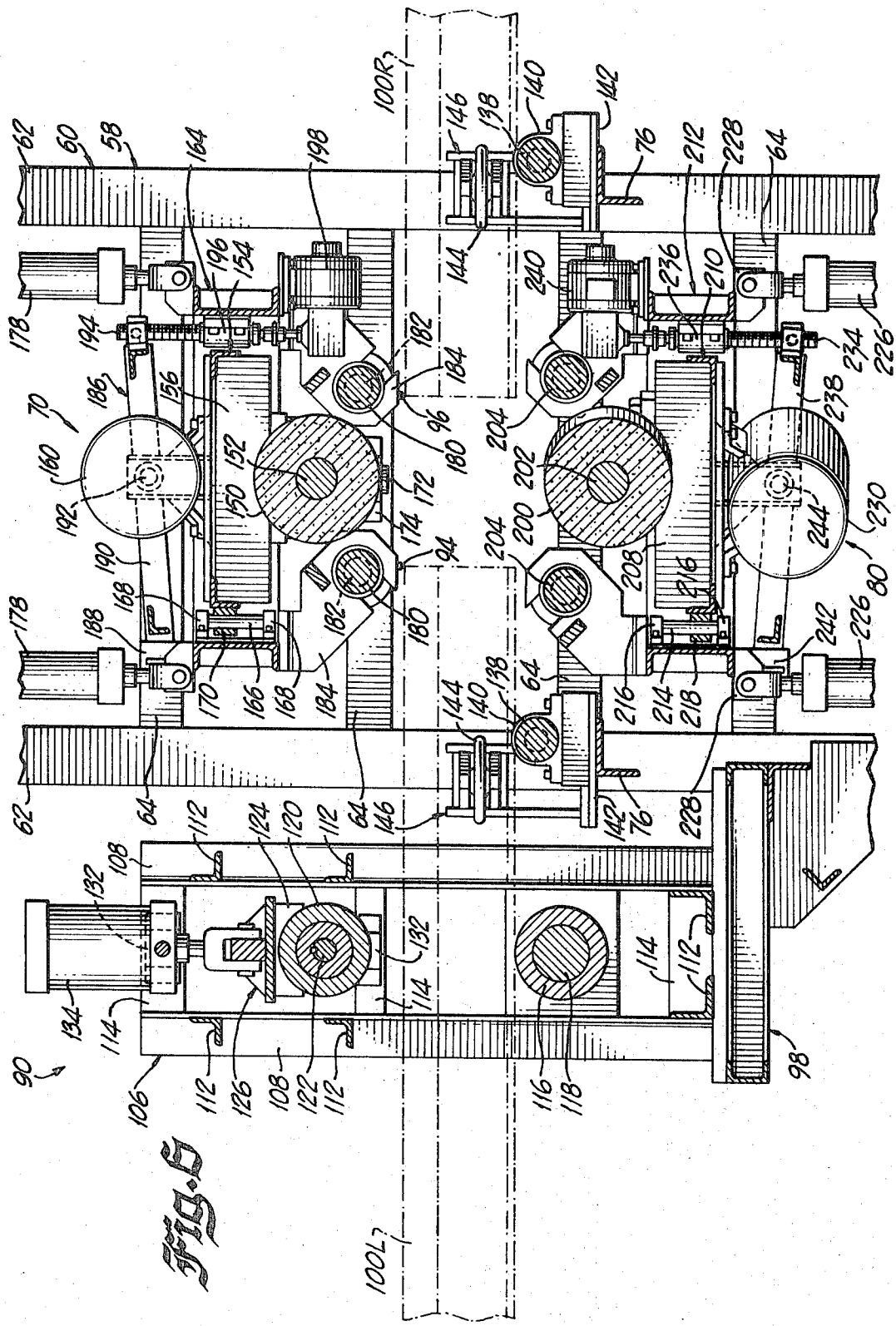


Fig. 6

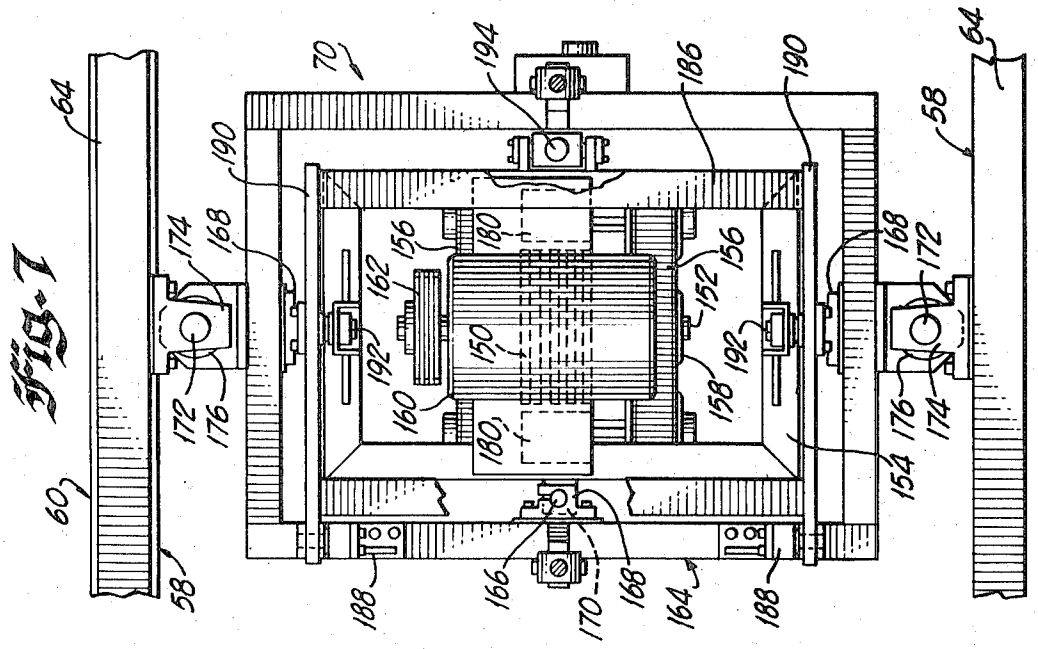

70
194
186
190
64
58
60
168
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176
156
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164
188

Fig. 7

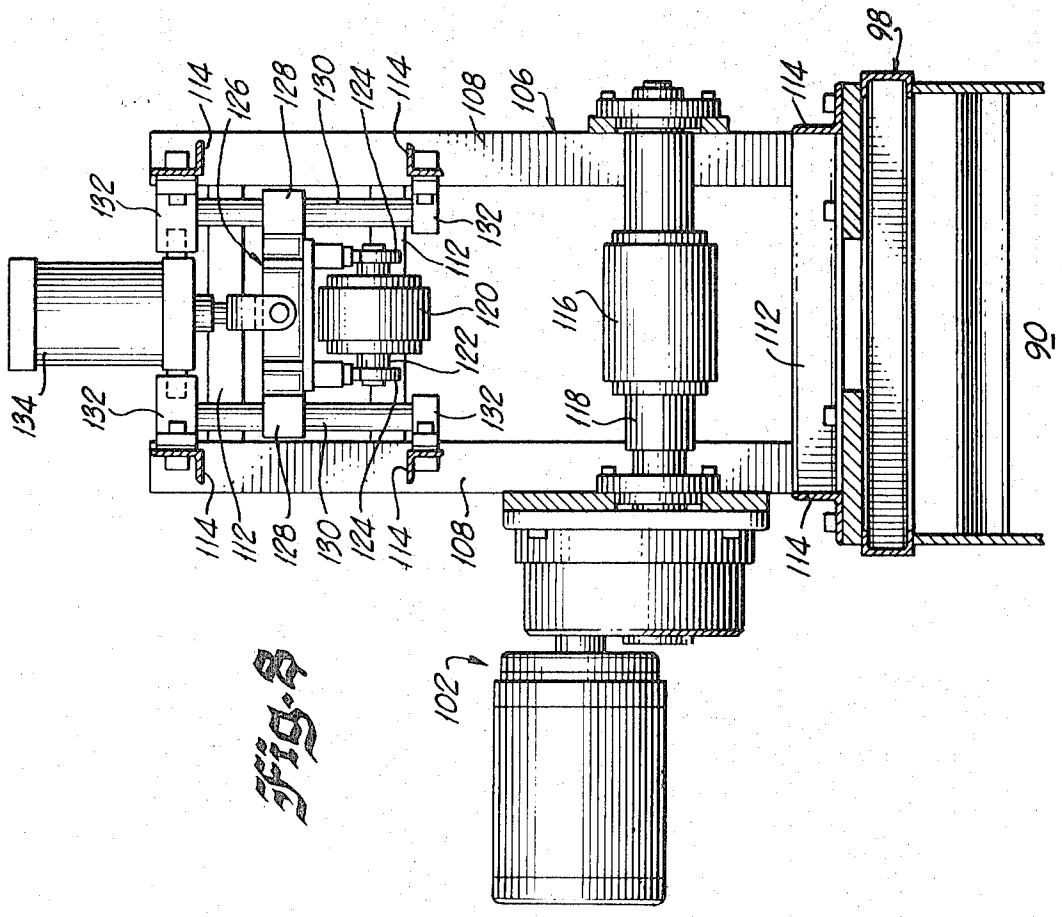

98
114
126
128
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112
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134
90
102

Fig. 8

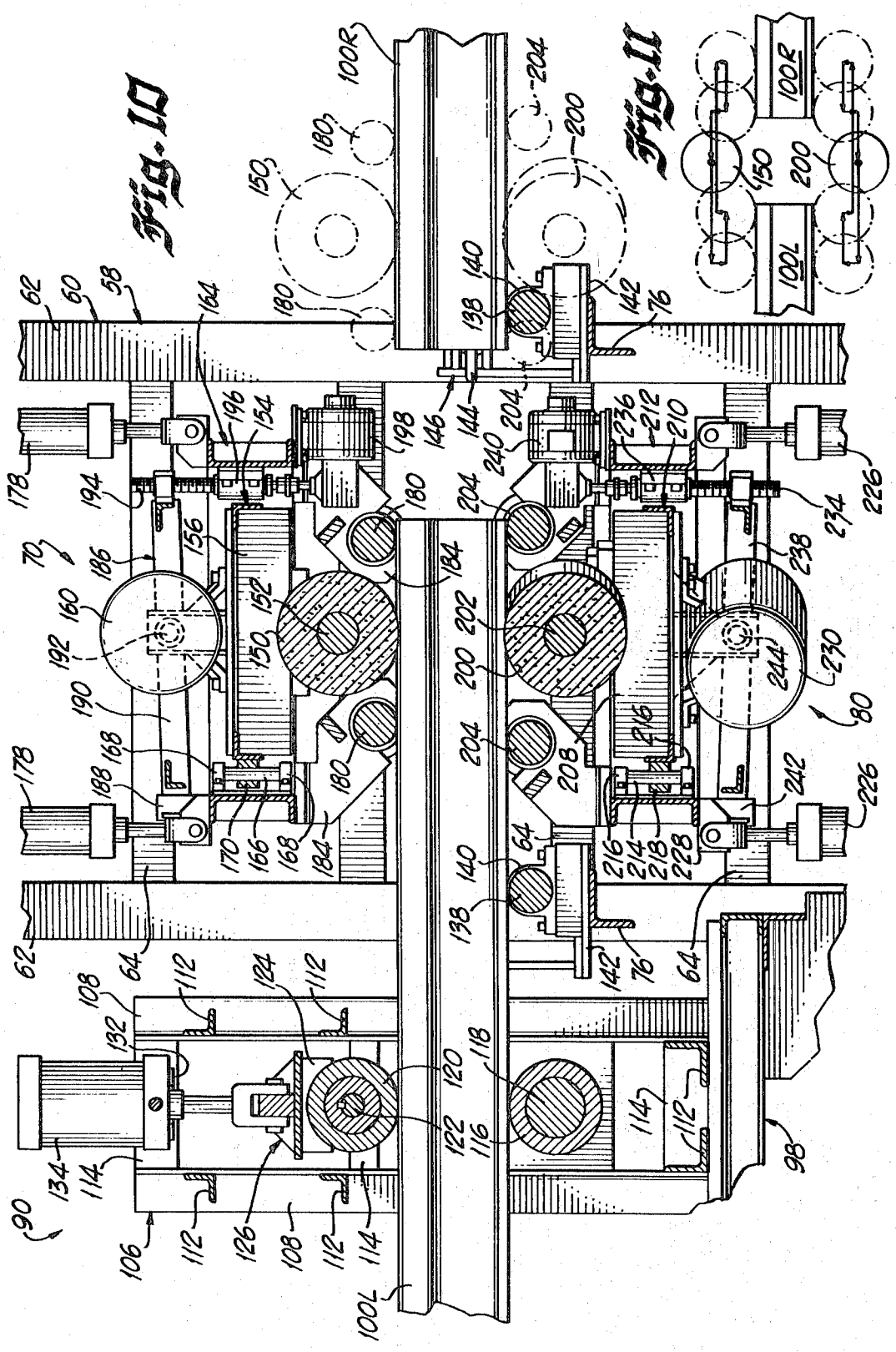
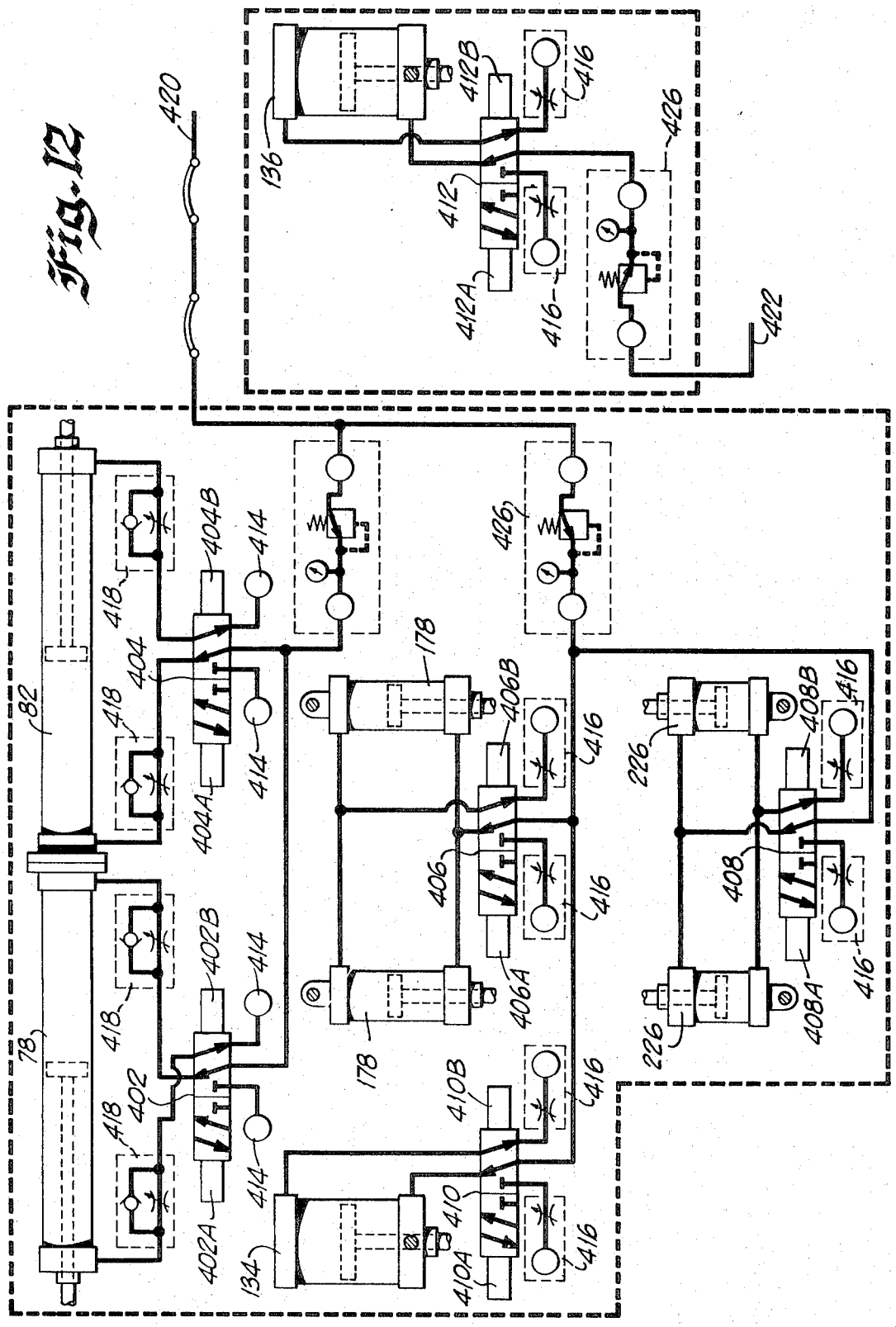

Fig. 10
Fig. 11

Fig. 12


420
136
412B
416
426
412
412A
416
422
82
78
418
404B
414
404
404A
402B
402
402A
134
178
406B
406
406A
410B
410
410A
426
226
408B
408
408A

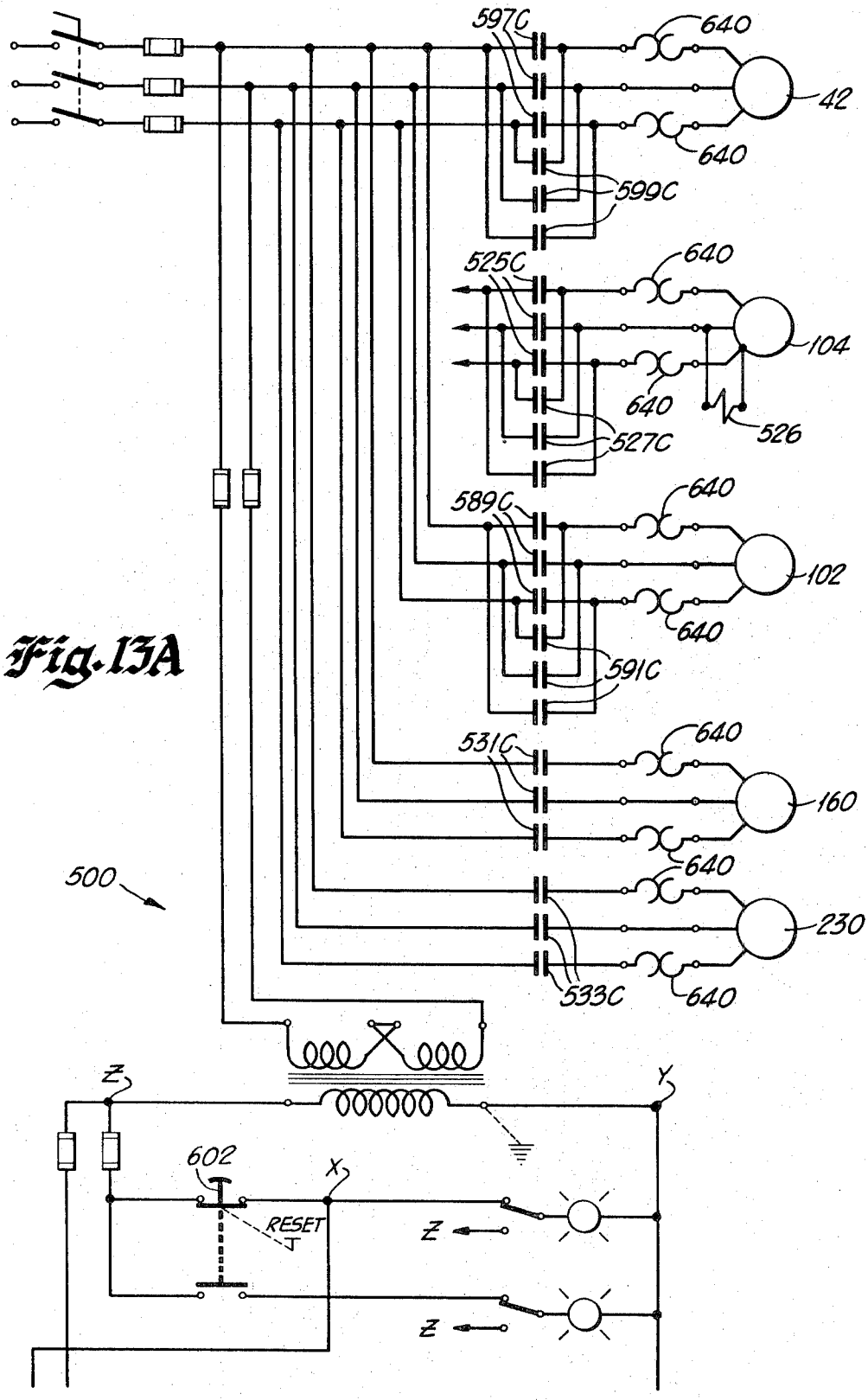

597C
640
42
640
599C
525C
640
104
640
526
527C
589C
640
102
640
591C
531C
640
160
640
500
230
533C
640
Z
Y
602
X
RESET
Z
Z

Fig. 13A

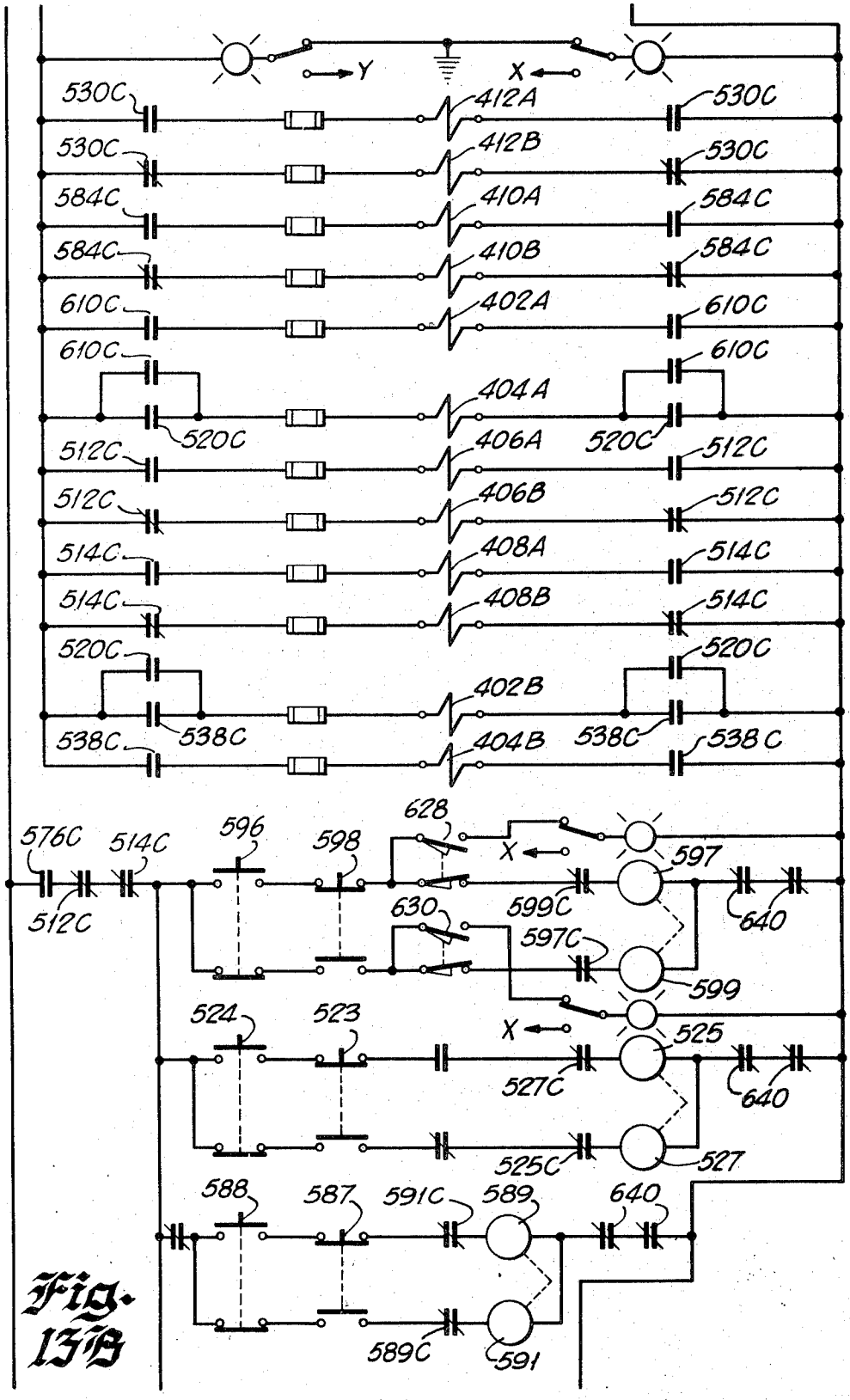

Y
X
530C
412A
412B
584C
410A
410B
610C
402A
404A
520C
512C
406A
406B
514C
408A
408B
538C
402B
404B
576C
596
598
628
597
599C
640
630
597C
599
524
523
525
527C
525C
527
588
587
591C
589
589C
591

Fig. 13B

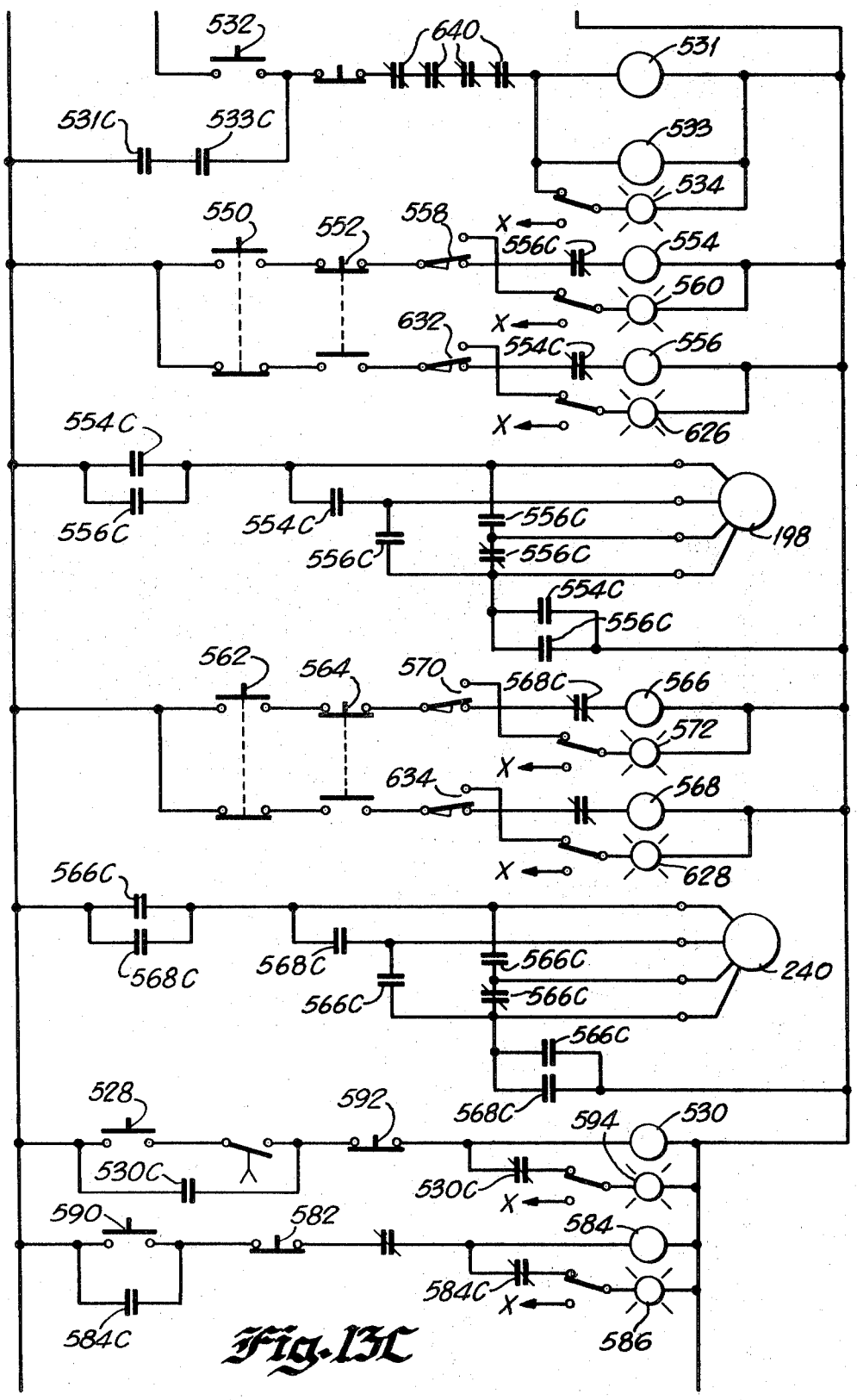

532
640
531
531C
533C
533
534
550
552
558
X
556C
554
560
632
554C
556
626
554C
556C
554C
556C
556C
198
554C
556C
562
564
570
568C
566
572
634
568
628
566C
568C
568C
566C
566C
566C
240
566C
568C
528
592
594
530
530C
530C
590
582
584
584C
584C
586

Fig. 13C

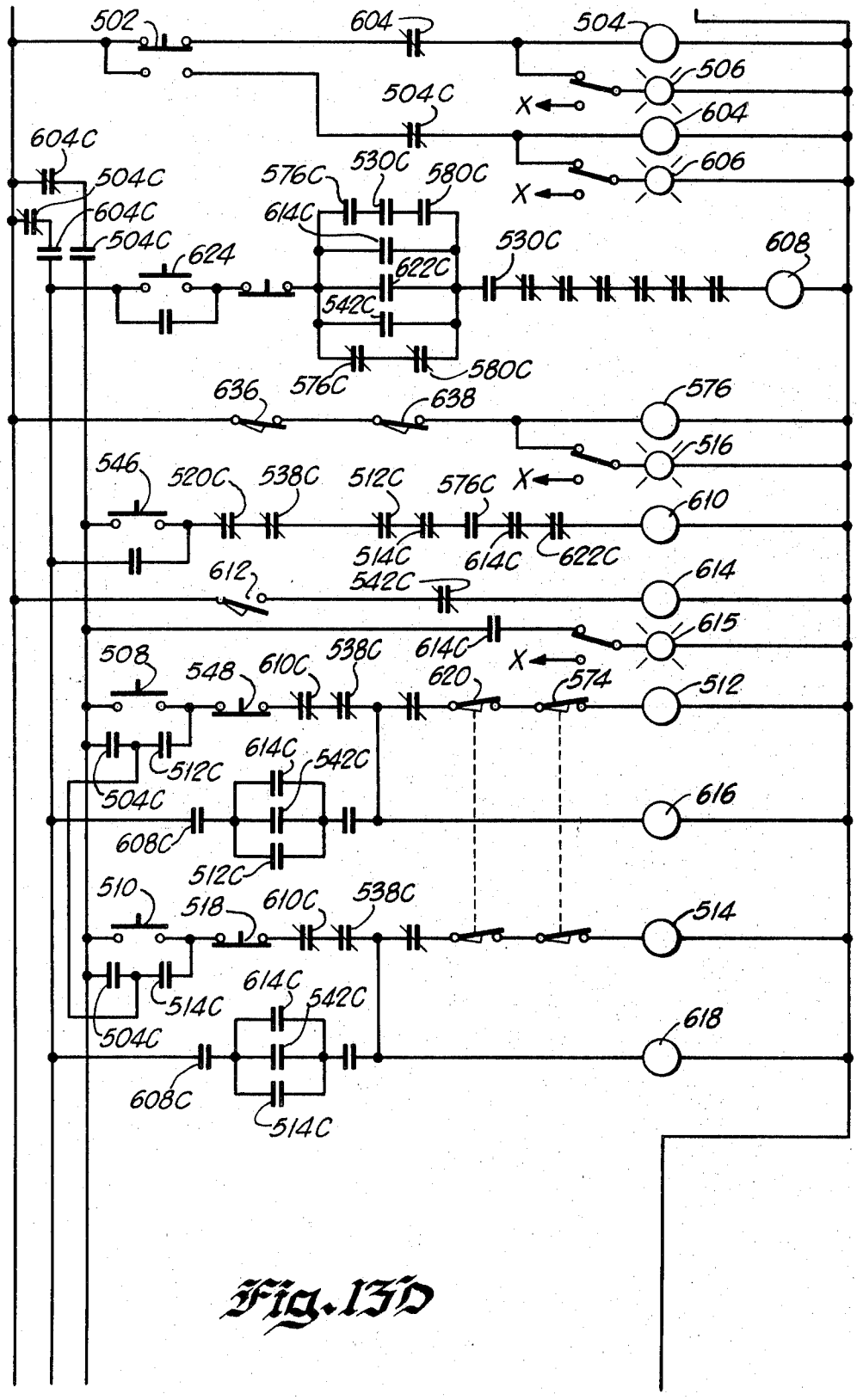

502
604
504
506
504C
X
604
604C
606
504C
530C
580C
576C
604C
614C
504C
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530C
608
622C
542C
580C
576C
636
638
576
516
546
520C
538C
512C
576C
X
610
514C
614C
622C
612
542C
614
615
508
548
610C
538C
614C
X
620
574
512
614C
542C
512C
504C
616
608C
512C
510
518
610C
538C
514
614C
542C
514C
504C
618
608C
514C

Fig. 13D

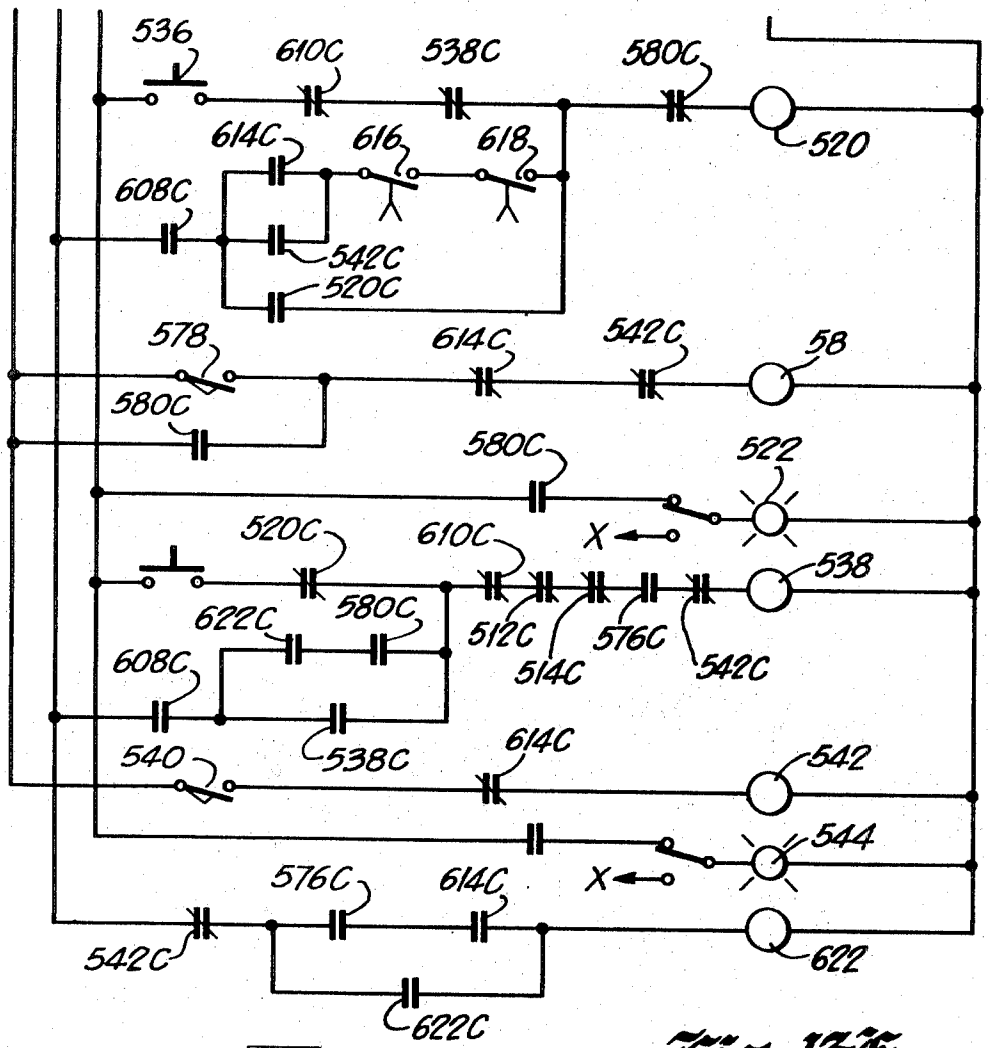


Fig. 13E

FIG. 13A
FIG. 13B
FIG. 13C
FIG. 13D
FIG. 13E

RAIL GRINDING MACHINE

This application is a division of copending U.S. Pat. application, Ser. No. 239,293, filed Mar. 29, 1972 now U.S. Pat. No. 3,818,650.

The present invention is directed towards a new and improved apparatus for grinding contact surfaces adjacent the ends of rail sections, and the like, which sections are subsequently welded into a continuous rail string. In the U.S. Pat. No. 3,030,494 which patent is assigned to the same assignees as the present invention, there is shown and described a new and improved method and apparatus for forming a continuous rail string and, more particularly, this patent is concerned with a new and improved method and apparatus comprising in combination several separate or individual subassemblies which coact to produce a continuous rail string in a novel manner and more quickly and easily than heretofore has been possible. One of the individual components or subassemblies of the foregoing patent is concerned with the problem of grinding contact surface areas adjacent the ends of the rail sections to be welded together in order that good electrical contact can be made between the rail sections and the electrodes of the rail welding during the welding of the rail sections end to end.

The present invention provides a new and improved apparatus for grinding electrode contact surfaces on rail sections and is an improvement over the showing in the aforementioned patent. The electrode contact grinder of the present invention is well suited for use as a component or subassembly in the rail string production system shown in the aforementioned patent. In conjunction with the present invention, a rail welder or welding apparatus such as that shown in U.S. Pat. No. 3,488,467 may be efficiently used in combination additionally with apparatus for grinding the weld upset produced by the rail welded. A suitable weld upset grinder is shown in U.S. Pat. No. 3,566,546, and both of these last two mentioned patents are assigned to the same assignee as the present invention.

One of the problems in making a continuous rail string is the fact that the individual rail sections which make up the string, as well as the continuous rail string itself, may have been warped, or twisted about the longitudinal axis which make it exceedingly difficult for the rail section surfaces to make good contact with the electrodes in the rail welding apparatus. High pressure contact over a relatively large area is needed for the high ampere current flow in making butt welds, particularly in connection with the rail base which is considerably wider in lateral dimension than the relatively narrow rail head surface which is slightly crowned. In the past it has been a difficult problem to grind suitable planar contact surfaces on those portions of the rail sections with accuracy and consistency so that high amperage current flow between the electrodes can be accommodated with minimum electrical resistance. This is particularly true when the end portions of the individual rail sections or the rail string are twisted about the longitudinal axis. When this occurs it is necessary to make a deeper grind to insure that ample surface area is provided for electrode contact. The problem is more acute with the relatively wide base portion of the rail sections than it is with the crowned head surfaces, however the grinding apparatus, in accordance with the present invention eliminates or greatly reduces the

foregoing problems and provides for more uniform and better welds in making a continuous rail string than heretofore possible.

It is an object of the present invention to provide a new and improved apparatus for grinding welding electrode, contact surfaces adjacent the ends of rail sections which are to be welded together into a continuous rail string.

Another object of the invention is to provide a new and improved apparatus for grinding parallel welding electrode contact surfaces adjacent the ends of rail sections on opposite sides, which surfaces are ground in more uniform and precise manner even though the rail sections are twisted or warped.

Another object of the present invention is to provide a new and improved apparatus for grinding welding electrode contact surfaces on opposite surfaces of rail sections, which surfaces are precisely parallel and are of ample size to provide for high amperage current flow with a minimum of contact resistance.

Another object of the present invention is to provide a new and improved apparatus for grinding welding electrode, contact surfaces on a pair of rail sections to be welded together in single, automatic operation in a minimum of time.

Still another object of the present invention is to provide a new and improved apparatus of the character described employing novel means for compensating for the wear of the abrasive means of the grinder which appears over a period of time.

Still another object of the present invention is to provide a new and improved apparatus of the character described, which apparatus is completely automatic in operation utilizing a pair of grinding heads accurately controlled to provide precisely parallel welding electrode contact surfaces on opposite sides of a pair of rail sections.

Another object of the present invention is to provide a new and improved grinder of the character described wherein the grinding heads move longitudinally of the rail sections and are disposed in grinding contact with opposite sides thereof while moving toward an outer end of the rail section which is held in positive longitudinal alignment with respect to the moving grinding heads.

Another object of the present invention is to provide a new and improved rail grinding system of the character described which is readily adjustable to compensate for wear in the abrasive material of the grinder and which is easily controlled to provide precision ground welding electrode, contact surfaces on opposite sides of the rail sections near their ends.

These and other objects and advantages of the present invention are accomplished in one embodiment of a new and improved apparatus in accordance with the present invention comprising squeeze roll means for holding one or more rail sections in precise, end-to-end, longitudinal alignment and abrasive grinding means including a plurality of wheels mounted on an axis of rotation extending laterally of the rail sections at an acute angle relative to the longitudinal axis thereof. Carriage means is provided for moving said grinding means longitudinally of the rail sections toward the ends thereof, and pressure means exerts force on the grinding means normal to the axis of rotation of the abrasive to provide grinding contact for a length of travel of the carriage and subsequent travel away from

the surface of the rail sections. Movement of the grinding means into and out of engagement is accomplished during longitudinal travel of the carriage to provide welding electrode contact surfaces on the rail sections near the ends.

For a better understanding of the present invention reference should be had to the following detailed description and appended claims, taken in conjunction with the drawings, in which:

FIG. 1 is a longitudinal side elevational view of a new and improved rail grinding apparatus constructed in accordance with the features of the present invention;

FIG. 2 is a top plan view of the rail grinding apparatus of FIG. 1;

FIG. 3 is a transverse cross-sectional view taken substantially along line 3—3 of FIG. 1;

FIG. 4 is a fragmentary, transverse, cross-sectional view taken substantially along line 4—4 of FIG. 1;

FIG. 5 is a fragmentary, horizontal, cross-sectional view taken substantially along 5—5 of FIG. 1;

FIG. 6 is a fragmentary, longitudinal, cross-sectional view taken substantially along line 6—6 of FIG 3;

FIG. 7 is a fragmentary, horizontal, cross-sectional view taken substantially along line 7—7 of FIG. 1;

FIG. 8 is a vertical, transverse, cross-sectional view taken substantially along line 8—8 of FIG. 1;

FIG. 9 is a vertical, transverse, cross-sectional view taken substantially along line 9—9 of FIG. 1;

FIG. 10 is a vertical, cross-sectional view similar to FIG. 6, but illustrating the apparatus with the grinding heads and grinding contact with the rail sections;

FIG. 11 is a schematic diagram illustrating in animated fashion the path traversed by the grinding heads relative to the rail sections;

FIG. 12 is a schematic diagram indicating a fluid control system of the apparatus; and

FIGS. 13A–E illustrate in schematic form an electrical control system for the grinding apparatus.

Referring now, more particularly to the drawings, in accordance with the present invention there is provided a new and improved rail grinder referred to generally by the reference numeral **20** in FIGS. **1, 2,** and **3.** The rail grinder **20** is especially adapted for grinding welding electrode, contact surfaces on opposite surface portions of longitudinal rail sections adjacent the ends thereof so that the rail sections may subsequently be welded together end-to-end in the rail welding apparatus of the type generally shown in U.S. Pat. No. 3,488,467, previously referred to.

The rail grinder **20** includes a main frame **22** comprising a rectangular, horizontal base structure **24** and a pair of longitudinal side frames **26** extending vertically upwardly along opposite, longitudinal outer edges of the base. As best shown in FIGS. **1, 2,** and **3,** the base structure **24** is constructed of longitudinal side channels **28** connected at the ends and intermediate the ends by a plurality of cross members **30.**

The rail grinder is mounted for movement along a track comprising a pair of spaced-apart, guide rails **32** and for this purpose pairs of flanged support wheels **34** are mounted on axles **36** supported by the base **24** adjacent opposite ends thereof, as best shown in FIGS. **1** and **2.** One of the axles **36** is driven to move the rail grinder along the rails **32** by means of a pair of spockets **38** and a chain drive **40,** which sprockets and chain drive interconnect the axle with a reversible, electrically powered main drive gearmotor **42.** The main drive, gearmotor **42** includes a reduction gear assembly so that the axle **36** is driven at relatively low speed and high torque in either direction to move the rail grinder up and down the rails **32** to any selected position.

Each of the side frames **26** of the main frame structure includes a pair of upright corner posts **44** supported from the base **24** and the posts are structurally interconnected at their upper ends by a pair of longitudinally extending, channels **46.** Suitable corner braces **48** of angle iron (FIG. **1**) are provided to structurally interconnect the posts **44** with the base side channels **28** and with the upper longitudinal channels **26.** In addition, transverse cross members **50** are provided at opposite ends of the frame to interconnect the channels **46** and provide a generally rectangular, rigid frame structure.

In accordance with the present invention, the main frame structure **22** provides support for a movable carriage **60** on which is mounted an upper grinding head **70,** a lower grinding head **80,** and an exit squeeze roll assembly **90.** As best shown in FIGS. **1** and **3,** the carriage **60** is movable longitudinally on the main frame structure **22** and is guided and supported for longitudinal movement by an upper, carriage support rod **52** and a lower carriage support rod **54.** The upper support rod or shaft **52** is supported on one of the longitudinal upper channels **46** of a side frame **26** by a plurality of upstanding support brackets **56,** as best shown in FIGS. **1** and **3,** and the lower support rod **54** is similarly supported by brackets **56** mounted on a lower base side channel **28** as shown. The carriage **60** comprises a pair of generally rectangular, vertical side frames **58,** each of which includes a pair of spaced-apart corner posts **62** which are interconnected by a plurality of horizontal cross members **64,** as best shown in FIG. **1.**

The upper ends of the posts **62** of the carriage side frame **58** adjacent the upper support rod **52** are interconnected by a horizontal, elongated hollow tubular member **66** (FIG. **3**), which member is secured to the upper support rod **52** for parallel, longitudinal sliding movement with respect thereto by a pair of guide sleeves **68** slidably disposed on the support rod and interconnected to the tubular member by means of laterally extending, parallel side brackets **72,** as best shown in FIGS. **1, 2** and **3.** Similar cylindrical guide sleeves **68** are mounted on the lower support rod **54,** and these sleeves are connected via a bracket **72** to an elongated, hollow, tubular support member **74** connected to the lower ends of the posts **62** on the opposite carriage side frame **58.**

From the foregoing description it will be seen that both of the opposite side frames **58** of the movable carriage **60** are supported for longitudinal sliding movement along the respective upper and lower carriage support rods **52** and **54** by means of hollow tubular, upper and lower support members **66** and **74,** respectively. The respective side frames **58** in turn are joined by transverse, cross members **76** which structurally tie the side frames together to form an integral relatively rigid box or cagelike carriage base structure.

Movement of the carriage longitudinally on the guide rods **52** and **54** from a centered position of FIGS. **1, 2** and **3** in opposite directions is accomplished by means of a pair of left and right, carriage traverse cylinders **78** and **82** mounted with their rod ends extending outwardly in opposite directions and their closed ends interconnected together, as best shown in FIG. **2.** The

cylinders are arranged in coaxial alignment on a central longitudinally extending vertical plane of the rail grinder and the outer end of the piston rod of the left-hand cylinder **78** is pivotally interconnected to an upper cross member **50** at the left-hand end of the main frame **22.** The outer end of the piston rod of the right-hand cylinder **82** is pivotally interconnected to a cross plate **84** disposed transversely between a pair of longitudinally extending angles **86** which are parallel and on opposite sides of the right hand cylinder **82.** The angles **86** are secured at opposite ends to the upper, transverse cross members **76** on the carriage frame, as best shown in FIGS. **2, 3,** and **4.**

Referring to FIG. **2,** when the carriage **60** is in a centered position, the piston rod in the left-hand cylinder **78** is fully extended and the piston rod in the right-hand cylinder **82** is fully retracted. In order to move the carriage to the left of center position, as shown in FIG. **10,** pressurized fluid is introduced into the cylinder **78** causing the piston rod to retract inwardly into the cylinder. In order to move the carriage from the carriage left position back to the center position, the flow of pressurized fluid into the cylinder **78** is reversed so that the piston rod is extended outwardly to a fully extended, outward position. To initiate right of center movement of the carriage from the center position to a right of center position (as indicated by dotted lines of the grinding wheels shown in FIG. **10**), pressurized fluid is introduced into the right-hand cylinder **82** causing the piston rod to be extended to a fully outward position. To return the carriage to the center position, the fluid flow is reversed to again retract the piston rod in the cylinder **82.** From the foregoing it will be seen that the right-hand and left-hand carriage traverse cylinders **78** and **82** control and set up left and right carriage traverse in a direction longitudinally of the grinder in both directions from a centered position. The length of stroke of the piston rod in each cylinder can be readily controlled and adjusted in order to provide the desired amount of carriage travel required.

In accordance with the present invention, the rail grinder **20** is especially adapted for grinding contact spots for welding electrodes on opposite head and base surfaces of a pair of longitudinally aligned railroad rail sections **100** L and **100** R, which sections are subsequently welded together end-to-end to form a continuous rail string. After the spot or contact grinding has been completed by the upper and lower grinding heads **70** and **80** on the traveling carriage **60,** the left-hand rail section **100** L, which is attached to the already completed welded rail string is moved to the left by the exit squeeze roll assembly **90,** and the right-hand rail section **100** R is moved to the left by a stationary, separate, incoming squeeze roll assembly **110,** which assembly is substantially identical in operating structure and characteristics to the exit squeeze roll assembly **90** on the carriage except for the fact that the incoming squeeze roll assembly is mounted on a separate table structure **92** (FIG. **1**) positioned in fixed relation, relative to track **32.** As described the exit squeeze roll assembly **90** is mounted on and travels with the longitudinally movable main carriage **60.**

As viewed in FIGS. **1** and **2,** after each new rail section is added to the continuous string of welded together rail sections additional new rail sections **100** R are brought into the grinder **20** from right to left (FIG. **1**) and the section **100** L and **100** R are in longitudinal alignment positioned with their ends in closely spaced apart, parallel facing relation as illustrated best in FIGS. **6** and **10.** The rail section **100** L on the rail string is moved from right to left by the exit squeeze roll assembly **90** until the right-hand end face is positioned directly beneath a left-hand pointer **94** on the upper grinding head **70,** and the incoming squeeze roll assembly **110** is energized to draw a new rail section **100** R into position wherein the left-hand end of the new section is positioned directly beneath a right-hand pointer **96** on the upper grinding head. The pointers **94** and **96** are used to establish a desired spaced-apart relation between the facing ends of the rail sections **100** L and **100** R, which ends are subsequently welded together to form the continuous rail string.

The exit squeeze roll assembly **90** is supported on a platform structure **98** (FIGS. **1, 6** and **10**) extending outwardly in cantilever fashion from the left-hand side of the carriage **60,** as shown in FIG. **1.** The exit squeeze roll assembly is driven by a low speed, high torque, reversible, electrically powered gear motor **102** and the incoming squeeze roll assembly **110** is driven by a similar gear motor **104.** Each of the squeeze roll assemblies includes an upright framework **106** having corner posts of angle iron disposed on opposite sides of the path traversed by the rail sections. The corner posts are interconnected by a plurality of horizontal, laterally transverse cross members **112,** as best shown in FIGS. **6** and **10** and the corner posts **108** on the same side of the rail sections are joined by horizontal cross members **114.** In order to support and move the base of the rail sections **100** L and **100** R, each squeeze roll assembly includes a lower, drive roll **116** carried on a drive axle **118,** which is supported in suitable bearing assemblies at opposite ends and driven by a respective gear motor **102** or **104,** as best shown in FIG. **8.**

Both squeeze rolls **90** and **110** serve a dual purpose in moving the rail sections longitudinally to desired positions and clamping or holding the rail section in precise longitudinal alignment. In order to insure positive driving and holding contact between the base of the rail sections and the drive rolls **116,** each squeeze roll assembly includes an upper, pressure roll **120** adapted to contact the head surface of the rail sections to urge the rail sections downwardly so that the base is in firm driving contact with the drive rolls **116.** The upper pressure rolls **120** are supported on horizontal axles **122,** which axles are supported for free rotation at opposite ends by bearing assemblies **124.** The bearing assemblies **124,** in turn, are mounted on horizontal, vertically adjustable, support base structures **126.** The support base structures **126,** are mounted for a vertical translation within the upright frame structures of the squeeze rolls and for this purpose each base structure includes a pair of cylindrical sleeves **128** at opposite ends, which sleeves are slidably disposed on a pair of guide rods **130** supported in parallel, vertical alignment on the inside of the upright frame structures **106** by bearing assemblies **132** at the upper and lower ends, as best shown in FIG. **8.** From the foregoing, it will be seen that the pressure rolls and drive rolls are journaled about parallel, vertically spaced, horizontal axes and that the upper, pressure rolls are adjustably positioned to move vertically toward and away from the lower drive rolls **116,** thereby to hold or release pressure on the rail sections for driving and/or supporting and holding the rail sec-

tions in precisely aligned contact between each pair of upper and lower rolls.

Vertical translation of the upper pressure rolls **120** is accomplished by a pair of pneumatic cylinders **134** and **136** provided on the respective squeeze rolls **90** and **110** and the outer or downward end of the vertical piston rod of each cylinder is pivotally interconnected with the roll supporting base structure **120** which is slidable up and down on the guide rods **130.** Fluid flow into and out of the upper and lower ends of the cylinders moves the upper pressure rolls **120** into and out of contacting engagement with the head surface of the rail sections as required. For clamping the rail sections tightly fluid is directed into the upper end of the cylinders **134** and **136** holding the rail sections down against the lower drive rolls **116** so that upon energization of the squeeze roll gear motors **102** and/or **104,** the rail sections will be moved in the desired direction.

As will be developed hereinafter the squeeze roll gear motors are provided with a braking mechanism used to prevent rotation of the lower drive roll **116** for the purpose of restraining the rail sections against longitudinal translation during a grinding operation as the grinding heads **70** and **80** mounted on the movable carriage **60** traverse back and forth. It should also be appreciated that while the upper pressure rolls are biased downwardly into pressure engagement against the head surface of the rail sections, the rail sections are restrained against vertical and laterally horizontal movement, however, longitudinal translation is permitted when desired by releasing the braking mechanism of one or both gear motors **102** and **104.** When the carriage **60** is moved longitudinally on the supporting main frame structure **22** during a cycle of grinding head operation, the braking mechanism of exit squeeze roll assembly **90** is released and the left-hand rail section **100** L is restrained against longtudinal translation by clamping means on the other components in the system acting on the rail string such as the welder or another external clamping device. The upper pressure rolls **120** of the squeeze roll assemblies are freely rotatable and may rotate in response to longitudinal translation of the carriage **60** or upon driving rotation of the lower drive rolls **116.**

In addition to the support and the vertical and horizontal alignment and guidance of the rail sections **100** L and **100** R provided by the exit and incoming squeeze rolls **90** and **110,** support is also provided by a pair of rolls **138** (best shown in FIGS. **4, 6** and **10**) mounted on shafts which are journaled for rotation by pillow blocks **140** carried on horizontal base platforms **142** provided on the carriage **60.** As best shown in FIGS. **4, 5, 6** and **10,** the bases **142** are supported from laterally transverse cross members **76** which extend between corner posts **62** of the traveling carriage **60.** As viewed in FIG. **4,** it will be seen that the base or bottom surfaces of the rail section **100** L and **100** R roll over and are supported on the freely rotatable guide rolls **138** as the rail sections move longitudinally relative to the carriage. Lateral guidance of the rail sections with respect to the carriage is provided by pairs of web engaging guide rolls **144,** best shown in FIGS. **4** and **5.** The web guide rolls **144** are mounted on vertical axles which are journaled in fixed and movable support bracket assemblies **146** and **148,** respectively, best shown in FIGS. **3, 4, 5** and **6.**

In accordance with the present invention, the upper grinding head **70** includes an upper grinding wheel **150** which comprises a plurality of cylindrical discs or wheels formed of abrasive material and mounted on a common shaft **152.** The shaft **152** is supported by pillow block bearings **158** at opposite ends mounted on a pair of support angles **156** (FIG. **4**) attached to a rectangular motor base **154** formed of angle iron. The grinding wheel shaft **152** is driven at relatively high speed by an electric motor **160** via a belt drive **162.**

The motor base **154** is supported for vertical, relative movement on a rectangular, upper grinding head frame **164** formed of channel iron. A plurality of vertical guide rods **166** are secured at their upper and lower opposite ends in pillow blocks **168** attached to the inside web of the grinding head frame **164** and the motor base **154** is provided with a plurality of bearing sleeves **170** on the sides thereof slidably disposed on the guide rods **166,** thus permitting relative vertical adjustment between the motor base **154** and the grinding head frame. The frame **164** in turn is mounted for vertical movement or translation on the carriage **60,** and for this purpose, vertical guide rods **172** are provided on the opposite side frames **58** of the carriage. The guide rods are supported at opposite ends by pillow blocks **174** secured to the cross members **64,** of the carriage side frames, as best shown in FIGS. **3** and **4.** Opposite side members of the upper grinding head frame **164** are provided with cylindrical sleeves **176** which are slidably disposed on the vertical guide rods **172** to permit relative vertical sliding movement of the frame **164** on the carriage **60.**

Control and vertical sliding movement of the upper grinding head frame **164** on the carriage **60** is accomplished by a pair of upper grinding head cylinders **178,** and the piston rods thereof are pivotally interconnected to the grinding head frame by means of clevis and bracket attachments as best shown in FIGS. **6, 10** and **3.** The upper, closed ends of the cylinders are pivotally connected to transverse cross members **76** of the carriage **60** so that when pressurized fluid is introduced into either end of the cylinders the frame **164** can be moved upwardly or downwardly on the carriage into or out of grinding engagement with the head surface of the rail sections **100** L and **100** R.

In order to adjust the vertical position of the upper grinding wheel **150** relative to the upper head surface of the rail sections **100** L and **100** R, the upper grinding head **70** includes a pair of upper pressure rolls **180** disposed on opposite sides of the grinding wheel axis of rotation as best shown in FIGS. **6** and **10.** Each pressure roll is mounted on an axle **182** parallel of the grinding wheel axle **152** and the axles **182** are supported at opposite ends from the grinding head frame **164** by means of support bearing assemblies **184,** as best shown in FIGS. **6** and **10.** From the foregoing it will be seen that the pressure rolls **180** are in a fixed vertical position relative to the main frame **164** of the upper grinding head **70** while the grinding wheel **150** itself is vertically adjustable with respect to the main frame in order to compensate for wear on the grinding wheel which occurs in consequence of the length of time that grinding engagement with the rail head surfaces of the rail section occurs. For the purpose of moving and adjusting for wear on the grinding wheel **150,** the upper grinding head **70** is provided with a control assembly for moving the motor frame **154** relative to and with respect to the

main grinding head frame **164.** The upper grinding head includes a rectangular adjusting frame **186** which is pivotally secured along one side by means of several pivot pin support assemblies **188** attached to a side member of the main grinding head frame **164** as best shown in FIG. **7.** Longitudinal side members **190** of the adjusting frame **186** are pivotally interconnected with parallel side members of the motor base **154** through pivot pin connector assemblies **192** for raising and lowering the motor base **154** with respect to the main grinding head frame **164.** Control of the pivotal relation between the pivotable adjusting frame **186** and the vertically movable motor base frame **154** is provided by means of a screw jack **194** (FIGS. **6** and **10**). The screw jack is threaded connected to one side member of the adjusting frame **186** and is mounted in vertical position for rotation in either direction to raise or lower the angle of adjusting frame relative to the main grinding head frame. The jack screw is supported in a guide sleeve **196** fastened to a transverse side member of the main grinding head frame **164** and rotation of the jack screw in either direction by a controlled amount is accomplished by means of a slow speed, electric driven, gear motor **198.** The adjusting gear motor is mounted on the same transverse side member of the main grinding head frame **164** as the sleeve **196** and is coupled to rotate the jack screw **194** when the motor is energized. From the foregoing, it will be seen that when the adjusting gear motor **198** is driven to rotate in either direction, the grinding wheel **150** is moved up and down relative to the main grinding head frame **164** and the pressure rolls **180** in order to compensate for wear occurring on the grinding wheel **150.** When the pressure rolls are moved downwardly into contact against the head surface of a rail section by the cylinders **178,** grinding will be effected by the fast moving outer periphery of the grinding wheel **150** and the depth of grind is controlled by the adjusting gear motor **198.** As wear occurs on the grinding wheel, the depth of grind will diminish correspondingly and to compensate for this wear, the adjusting gear motor **198** is energized for a selected period or number of revolutions to lower the grinding wheel **150** to provide the same desired depth of grind or grinding pressure as originally set up.

In accordance with the present invention, the lower grinding head **80** includes an abrasive grinding wheel **200** comprising a plurality of grinding wheel discs mounted on a common shaft **202.** Rather than a perpendicular alignment with respect to the rail sections as the upper shaft **152** is set up, the lower shaft is aligned at an acute angle with respect to the longitudinal axis of the rail sections as best shown in FIG. **5** and while both the upper and lower grinding wheel shafts are horizontal, they are not parallel. The lower grinding wheel **200** is adapted to move upwardly into contact against the under surfaces of the base of the rail sections and it has been found that by adjusting the axis of rotation of the grinding wheel away from a perpendicular to a lateral direction to an acute angle relative to the longitudinal axis of the rail section better grinding occurs. With the upper shaft **152** laterally perpendicular and horizontal, and the lower shaft **202** horizontal but at an acute angle in a lateral direction with respect to the longitudinal axis of the rail sections slight variations comprising twists or winds in the rail sections are better compensated for as the spot grinding occurs. The clamping effect on the rail sections between the upper and lower grinding wheels moving longitudinally toward the ends of the rail sections produces welding electrode contact surfaces that are exactly parallel. Except for the difference in angular arrangement of the grinding wheel axle with respect to the longitudinal axis of the rail sections, the lower grinding head **80** is substantially similar to the upper grinding head **70** and includes a pair of pressure rolls **204** disposed on opposite sides of the guiding wheel **200** for guiding contact with the rail base. The guiding wheel axle **202** is supported on a pair of pillow block bearings **206** mounted on a pair of angles **208** which are attached to a rectangular lower motor base frame **210** formed of angle iron. The lower motor base frame **210** is mounted for vertical sliding movement with respect to a larger lower grinding head main frame **212** formed of channels and of rectangular shape as shown. The lower motor base frame **210** is supported for vertical sliding movement with respect to the lower grinding head main frame **212** by a plurality of vertical guide rods **214** secured to the inside surface of the main frame by bearing blocks **216** at opposite ends of the guide rods. Sleeves **218** are mounted for sliding disposition on the guide rods **214,** and the sleeves are attached to side members of the motor base frame **210** so that the motor base frame is slidable in continuously parallel and vertical translation with respect to the lower grinding head main frame. The grinding head main frame in turn is mounted for vertical translation with respect to the carriage **60** on vertical guide rods **220** supported at opposite ends by bearing blocks **222** attached to the carrier side frame cross members **64,** as best shown in FIG. **4.**

Opposite side members of the lower grinding head frame are provided with sleeves **224** slidably disposed on the guide rods **220,** as best shown in FIGS. **3, 4** and **5,** and the lower grinding head main frame is controlled for movement up and down on the traverse carriage **60** by means of a pair of lower grinding head control cylinders **226** having the upper ends of their piston rod pivotally connected to the grinding head main frame through connector bracket **228,** as best shown in FIGS. **6** and **10.** The lower ends of the lower head control cylinders are pivotally connected to transverse cross members **76** of the carriage **60** as shown in FIG. **4,** so that the introduction of fluid under pressure into the lower ends of the cylinders elevates the lower grinding head **80** on the carriage **60** and a reverse flow of the fluid into the cylinder provides for a lowering of the grinding wheel **200** away from contact with the base of the rail sections. The lower grinding wheel is driven by an electric motor **230** secured to the underside of a motor base **210** and the motor is drivingly interconnected with the lower grinding head shaft **202** via a belt drive **232.**

When pressurized fluid is introduced into the lower end of the lower grinding head control cylinders **226,** the grinding head main frame **212** is moved upwardly on the carriage **60** until the lower grinding head pressure rolls **204** contact the underside of the rail sections **100** L and **100** R. Adjustment of the depth of grind is controlled by means of a motor driven jack screw **234** supported for rotation in a vertical bearing assembly **236** mounted on the inside of a transverse cross member of the grinding head main frame. The lower end of the jack screw is pivotally connected to a transverse side member of a lower adjusting frame **238** and the upper end of the jack screw is driven to rotate in either direction at a low speed by means of a lower grinding

head adjusting gear motor **240.** The electrically powered gear motor **240** supplies high torque in either direction to control the upward or downward movement of the grinding wheel **200** relative to the frame **212.** As best shown in FIGS. **3** and **4,** the lower adjusting frame **238** is pivotally secured to the grinding head main frame by bearing bracket assemblies **224** mounted on a transverse member opposite the side member connected to the jack screw **234.** Side members of the adjusting frame **238** generally parallel with the side frame **58** of the carriage **60** are pivotally interconnected to the lower grinding head motor base **210** through bearing block and bracket assemblies **244** so that as the lower jack screw **234** is driven to rotate in either direction, the motor base **210** is moved up or down relative to or with respect to the lower grinding head main frame **212** in order to adjust the depth of grind and compensate for grinding wheel wear.

From the foregoing, it will be seen that the depth of grind of the upper grinding wheel **150** and lower grinding wheel **200** is controlled and adjustable by means of upper and lower grinding head adjustment motors **198** and **240,** respectively. Guiding contact between the upper and lower grinding heads and the upper and lower surfaces of the rail sections is provided by the upper and lower pressure rolls **180** and **204,** as shown in FIGS. **6** and **10** and movement of the upper and lower grinding heads into and out of grinding engagement with the rail sections is controlled by a pair of cylinders **178** on the upper grinding head and a pair of cylinders **226** on the lower grinding head. The carriage **60** is caused to translate back and forth in both directions from either side of a center position (FIG. **6**) by means of a pair of end-to-end carriage traverse cylinders **78** and **82.**

FIG. **11** illustrates schematically the path of traverse of the upper and lower grinding wheels **150** and **200** with respect to the rail sections **100** L and **100** R which have been prepositioned with their end faces in spaced-apart, parallel relation. During the grinding cycle the rail sections are held against longitudinal, horizontal and transverse movement by the squeeze rolls **90** and **110** and the grinding wheels. In order to control the operation of the squeeze rolls **90** and **110,** the carriage **60,** and the upper and lower grinding heads **70** and **80,** the rail grinding **20** includes a fluid control system **400** (FIG. **12**). The carriage **60** is moved longitudinally by the left and right traverse cylinders **78** and **82** and the fluid flow to the cylinder **78** is controlled by a double acting, solenoid controlled valve **402** having control coils **402A** and **402B.** The right hand traverse cylinder **82** is controlled by a similar double acting solenoid controlled valve **404** having solenoid coils **404A** and **404B.** Similarly, fluid flow to the upper grinding head control cylinders **178** is controlled by a double acting solenoid controlled valve **406** having solenoid coils **406A** and **406B** while the fluid flow to the lower grinding head cylinders **226** is controlled by a double acting solenoid controlled valve **408** having solenoid coils **408A** and **408B.** The exit squeeze roll clamping cylinder **134** is controlled by a double acting solenoid controlled valve **410** having solenoid coils **410A** and **410B** and the incoming squeeze roll clamping cylinder **136** is controlled by a double acting solenoid valve **412** having solenoid coils **412A** and **412B.**

Fluid exhausted from the double acting, solenoid controlled valves **402** and **404** passes out through fluid exhausts **414** and fluid exhausts **416** with flow control devices provided for the valves **406, 408** and **410.** The rate of pressurized fluid flow into and out of the traverse cylinders **78** and **82** is adjustably regulated by flow rate regulator valves **418** in order to control the speed of the lateral movement of the traverse carriage **60.**

Pressurized fluid for operating the control cylinders of the rail grinder **20** is provided from one or more separate external sources through fluid input flow lines **420** and **422.** The pressurized fluid for operating the traverse control cylinders **78** and **82** of the rail grinder **20** is regulated by filter-regulator-lubricator **424** while two filter-regulator-lubricator sets **426** are provided for the other cylinders.

FIGS. **13**A through E illustrate in schematic form an electrical control system **500** for the rail grinder **20.** The control circuit **500** comprises a plurality of control relays which are numerically designated on the drawings and whose contacts carry the same numerical designations as the associated relay with the addition of a suffix "C." For example, the relay **597** controls the contacts **597C.**

In order to describe the function and operation of the control circuit **500,** an operational sequence of the rail grinder **20** is set forth as follows: An initial set-up procedure for operating the rail grinder **20** is started by placing a selector switch **502** in the "manual" position to energize a relay **504** and a "manual" light **506.** Two pushbutton switches **508** and **510** are pressed to de-energize two relays **512** and **514,** to energize two solenoids **406B** and **408B** and to thereby bring the upper grinding head **70** and the lower grinding head **80** to their out positions away from engagment with the rail sections. Simultaneously, a light **516** is energized to indicate that the grinding heads **70** and **80** are in the "out" position.

A "carriage center" pushbutton switch **518** is pressed energizing a relay **520** and thereby also energizing the solenoids **402B** and **402A** to bring the carriage **60** to the center position on the machine frame **22** which is indicated by a light **522.** An "incoming squeeze roll forward" pushbutton switch **524** is pressed to energize a relay **525,** thereby starting the incoming squeeze roll motor **104** in a forward direction and an electric braking mechanism **526** is released when the motor **104** starts. The left end of a rail section **100** R is brought into the rail grinder **20** by the forward rotation of the motor **104** and the motor **104** may be operated in a reverse direction by pressing a pushbutton switch **523** to energize a relay **527.**

An "incoming squeeze roll in" pushbutton switch **528** is pressed to energize a relay **530,** thereby also energizing the solenoid **412A.** The pushbutton switch **524** is released when the left end of the rail section **100** R is under a right-hand pointer **96** on the upper grinding head **70.** The rail section **100** R is now clamped into position.

A "grinding wheel start" pushbutton **532** is next pressed to energize two relays **531** and **533** to thereby start the grinding wheel motors **160** and **230.** At this time, a "grinding wheel running" light **534** is also energized.

A "carriage right" pushbutton switch **536** is pressed energizing a relay **538** and thereby also energizing the solenoids **402B** and **404B.** The carriage **60** travels to the right and eventually trips a limit switch **540,** which

may be mounted on the main frame **22**, when the carriage **60** reaches its maximum right position to thereby de-energize the relay **538** and to energize a relay **542** and a "carriage is right" light **544**.

An "upper grinding head in" pushbutton switch **546** and a "lower grinding head in" pushbutton switch **548** are pressed to energize the relays **512** and **514** which in turn energize the solenoids **406A** and **408A**. Next, either an "upper grinding wheel in" pushbutton switch **550** or an "upper grinding wheel out" pushbutton switch **552** is pressed to energize either a relay **554** or a relay **556** to start the upper wheel adjust motor **198** to compensate for grinding wheel wear. If the grinding wheel **150** is worn more than a predetermined amount an "upper wheel safety in" limit switch **558**, which is mounted on the upper grinding head **70**, trips to de-energize the relay **554** and to energize an "upper wheel in" light **560**.

A "lower grinding wheel in" pushbutton switch **562** or a "lower grinding wheel out" pushbutton switch **564** is pressed to energize either a relay **566** or a relay **568** to thereby start the lower wheel adjust motor **240** to compensate for grinding wheel wear. If the lower grinding wheel **200** is worn more than a predetermined amount, a "lower wheel safety in" limit switch **570**, which is mounted on the lower grinding head **80**, trips to de-energize the relay **566** and to energize a "lower wheel in" light **572**.

The "carriage center" pushbutton switch **518** is pressed to energize the relay **520**, thereby energizing the solenoids **404A** and **402B**. The carriage **60** travels towards the center position of the rail grinder **20**. At a predetermined distance to the right of the center position, for example, 7 inches, the carriage **60** trips a limit switch **574**, which is mounted on the main frame **22**, to de-energize the relays **512** and **514**, and thereby energize the solenoids **406B** and **408B**. This enables the upper grinding head **70** and the lower grinding head **80** to return to their out positions, and thereby energize a relay **576** and the "grinding heads out" light **516**. When the carriage **60** reaches the center position, it will trip a "carriage center" limit switch **578**, which is also mounted on the main frame **22**, to energize a relay **580** and the "carriage is centered" light **522**. The relay **520** is also de-energized. Thus, the carriage **60** stops at the center position.

An "exit squeeze roll out" pushbutton switch **582** is pressed to de-energize a relay **584** and to thereby energize the solenoid **410B** and an "exit squeeze roll out" light **586**. The "incoming squeeze roll forward" pushbutton switch **524** and an "exit squeeze roll forward" pushbutton switch **588** are pressed energizing a relay **589** and starting the squeeze motors **102** and **104**. The exit squeeze roll motor **102** may be driven in the reverse direction by pressing a pushbutton switch **587** to energize a relay **591**. When the end of the rail **100** R is under the exit squeeze roll **90**, the pushbutton switches **524** and **588** are released.

An "exit squeeze roll in" pushbutton switch **590** is pressed to energize the relay **584** and thereby also energize the solenoid **410A**. The pushbutton switches **524** and **588** are pressed to transfer the rail string **100** into the welder. These switches are released when the rail string **100** is held by the welder. The "exit squeeze roll out" pushbutton switch **582** is pressed to de-energize the relay **584** and thereby energize the solenoid **410B** and the "exit squeeze roll out" light **586**. An "incoming squeeze roll out" pushbutton switch **592** is pressed to de-energize the relay **530** and thereby energize the solenoid **412B** and an "incoming squeeze roll out" light **594**.

A "main drive left" pushbutton switch **596** or a "main drive right" pushbutton switch **598** is pressed to energize either a relay **597** or a relay **599** to start the main drive motor **42**. Either the pushbutton **596** or the pushbutton **598** is held until the end of the rail string **100**, (now section **100** L) held by the welder, is under the left-hand pointer **94** on the upper grinding head **70**.

The "incoming squeeze roll forward" pushbutton switch **524** is pressed to start the incoming squeeze roll motor **104**. When a new rail section **100** R is in the incoming squeeze roll **110**, the "incoming squeeze roll in" pushbutton **528** is pressed to energize the relay **530**, thereby energizing solenoid **412A**. The pushbutton **524** is held until the end of the new rail **100** is under the right-hand pointer **96** on the upper grinding heads **70**. Once the rail grinder **20** has been set up, it is not necessary to go through the set up procedure again unless it is desirable to change the length of rail sections to be ground.

In order for the rail grinder **20** to grind automatically, the upper grinding head **70** and the lower grinding head **80** are in their "out" positions; the incoming squeeze roll **110** is in the "in" position; the carriage **60** is in its center position; the main drive motor **42**, the exit squeeze roll motor **102** and the incoming squeeze roll motor **104** are not running; and an "emergency stop" pushbutton switch **602** is closed. The pushbutton selector switch **502** is turned to its automatic position to energize the relay **604** and an "auto on" **606**. The "grinding wheel start" pushbutton switch **532** is pressed to start the upper grinding wheel motor **160** and the lower grinding wheel motor **230** and the "grinding wheels running" light **534** illuminates.

The "cycle start" pushbutton switch **582** is pressed to energize a relay **608** which in turn energizes a "carriage left" relay **610**. The relay **610** energizes the solenoids **402A** and **404A**. The carriage **60** travels left and at its maximum point of travel trips a "carriage left" limit switch **612**, mounted on the main frame **22**, to energize a relay **614** and a "carriage is left" light **615**. The relay **614** de-energizes the relay **610** and energizes the "upper grinding head in" relay **512**, the "lower grinding head in" relay **514** and two time delay relays **616** and **618**. The relays **512** and **514** energize the solenoids **406A** and **408A**; thus, both upper and lower grinding heads **70** and **80** advance toward engagement with the rail section **100** L. After the time-out of the time delay relays **516** and **518** has run, the timed contacts closed energizing the "carriage center" relay **520**. The relay **520** locks in through its own contacts and energizes the solenoids **404A** and **402B** to cause the carriage **60** to travel towards its center position. At a predetermined distance left of the center position, for example, 7 inches, the carriage **60** trips a limit switch **620**, which is also mounted on the main frame **22**, which in turn de-energizes the relays **512**, **514**, **616** and **618**. The solenoids **406B** and **408B** are thus energized causing both grinding heads **70** and **80** to return to their "out" position.

When the carriage **60** reaches its center position, it trips the limit switch **578** energizing the relay **580**. The relay **580** in turn energizes the relay **538** to in turn energize the solenoids **402B** and **404B** causing the car-

riage **60** to travel to the right until it trips the limit switch **540** which energizes the relay **542.** The relay **542** locks in the relays **512, 514, 616, 618** and an "end of cycle" relay **622.** The relays **512** and **514** de-energize the relay **542** and energize the solenoids **406A** and **408A** causing both grinding heads **70** and **80** to advance to the rail section **100** R.

After the time-out period of the time delay relays **616** and **618** has expired, the timed contacts close energizing the "carriage center" relay **520** which locks in through its own contacts. The relay **520** energizes the solenoids **404A** and **402B** to cause the carriage **60** to travel towards its "center" position. At a predetermined distance right of the center position, the carriage **60** trips the limit switch **574** de-energizing the relays **512, 514, 616, 618** and **542** and thereby energizing the solenoids **406B** and **408B.** Thus, both grinding heads **70** and **80** will return to their "out" positions. When the carriage **60** reaches its "center" position, it trips the limit switch **578** energizing the relay **580.** The relay **580** de-energizes the "cycle start" relay **608** and the relay **520** causing the carriage **60** to stop and the relay **622** to de-energize. A pair of normally closed contacts controlled by the relay **622** set up the relay **608** for the next grinding cycle.

After the rail string **100,** held by the welder is removed from the rail grinder **20,** the procedure set forth above is followed to transfer the next rail section **100** toward the welder. Also, the above procedure is followed to bring a new rail section **100** R into the rail grinder **20.** To start the next grinding cycle, the "cycle start" pushbutton switch **582** is pushed to energize the relay **608** and to repeat the automatic grinding operation set forth above.

A "cycle stop" pushbutton switch **624** de-energizes the relay **608** and thereby stops the grinding cycle only when the carriage **60** is at its "left," "right" or "center" positions. To continue the grinding cycle, the pushbutton switch **582** is pressed.

If the operator wishes to repeat the left half of the grinding cycle, he should wait until the carriage **60** has been "left" and has started towards its "center" position. The "cycle stop" pushbutton switch **624** is pressed to cause the carriage **60** to stop at its "center" position. To repeat the left half of the grinding cycle, the pushbutton switch **582** is pressed.

If the operator wishes to repeat the right half of the grinding cycle, he should wait until the carriage **60** has been "right" and has started to return to its "center" position. The carriage **60** will stop at its "center" position with the grinding heads **70** and **80** in their "out" position. The selector switch **502** should be placed in its manual position and a pushbutton switch **526** should be pressed. When the carriage **60** reaches its right-hand position, the selector switch **502** should be placed in the automatic position after which the pushbutton switch **582** should be pressed. This will cause the right half of the grinding cycle to be repeated.

The limit switches **628, 630, 632, 634, 636,** and **638** are used in controlling the operating cycle of the rail grinder **20.** The limit switches **628** and **630** are both advantageously mounted on the main frame **22** and are tripped when the carriage **60** is at its extreme "left" position or at its extreme "right" position, respectively. The limit switches **632** and **634** are mounted on the upper grinding head **70** and on the lower grinding head **80,** respectively, and open when the motor frames are at their maximum out positions. The limit switches **636** and **638** are mounted on the carriage frame **58** and are held closed by the upper grinding head **70** and the lower grinding head **80** being in their out positions, respectively, and open when the respective grinding head leaves its out position.

Each of the motors **42, 102, 104, 160** and **230** are provided with overload protection devices **640.** These protection devices are designed to cause an open circuit and thus de-energize the motor upon the occurrence of an overloading or overheating condition. The overload protection devices **640** may advantageously be thermally actuated switch mechanisms.

Many modifications and variations of the present invention are possible in light of the above teachings, it is therefore to be understood that, within the scope of the appended claims, the invention may be practiced otherwise and as specifically described.

Although the present invention has been described with reference to a single illustrative embodiment thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. Apparatus for grinding surfaces adjacent the ends of rail sections to be welded together comprising clamping means for holding said sections in end-to-end longitudinal alignment; abrasive grinding means comprising a plurality of abrasive wheels mounted side by side on a common axle and driven to rotate around an axis of rotation extending laterally transverse of said rail sections at an acute included angle relative to the longitudinal axis thereof; carriage means for moving said grinding means longitudinally of said rail section toward and away from an end thereof and pressure means for moving said grinding means normal to said axis of rotation thereof toward and away from surfaces on said rail sections into and out of grinding engagement therewith as said grinding means moves toward said end.

2. The grinding apparatus of claim **1** including means mounting said grinding means and said clamping means on said carriage means for longitudinal movement therewith, said clamping means including a pair of clamping rolls on opposite sides of one of said rail sections biased toward one another to restrain said section against lateral movement during longitudinal travel of said carriage.

3. The grinding apparatus of claim **2** including second clamping means independent of said first mentioned clamping means and carriage means for holding the other of said rail sections in fixed position against transverse, lateral and longitudinal movement as said means moves longitudinally, said second clamping means including a pair of clamping rolls on opposite sides of said other rail section biased toward one another to restrain movement of said section.

4. The grinding apparatus of claim **3** including motor means for power driving at least one roll of said second clamping means.

5. The grinding apparatus of claim **2** including motor means for power driving at least one clamping roll of said first mentioned clamping means.

6. The grinding apparatus of claim **3** including brake means for locking at least one clamping roll of said sec-

ond clamping means against rotation and releasable to permit rotation thereof.

7. The grinding apparatus of claim **1** including second abrasive grinding means on said carriage means for grinding surfaces on said rail sections on an opposite side with respect to surfaces ground by said first mentioned grinding means, said second grinding means including abrasive means movable around an axis of rotation normal to the longitudinal axis of said rail sections.

8. The grinding apparatus of claim **7** wherein at least one of said grinding means includes an assembly comprising a pair of rail sections engaging pressure rolls disposed in spaced relation longitudinally of said rail sections on opposite sides of the axis of rotation of said grinding means, and means adjustably supporting said grinding means for movement relative to said guide rolls in a direction normal to said rail sections for adjustably controlling the depth of grind upon movement of said grinding means into grinding engagement of said pressure means.

9. The grinding apparatus of claim **1** wherein said grinding means includes an assembly comprising a pair of pressure rolls spaced longitudinally with respect to said rail sections on opposite sides of said axis of rotation of an abrasive grinding member; said pressure means comprising a support base mounted on said carriage means for movement normal to said rail sections toward and away therefrom and supporting said pressure rolls, and grinder support means carrying said grinding member for movement normal to said rail sections toward and away therefrom relative to said base for adjustably controlling the depth of grinding action on said rail sections relative to said pressure rolls.

10. The grinding apparatus of claim **9** wherein said pressure rolls are mounted on said support base and said grinder support means is slidably disposed on said base, and adjustment means for positioning said grinder support means in selected positions relative to said base.

11. The grinding apparatus of claim **10** wherein said adjustment means includes a frame pivotally mounted on said base and pivotally connected to said grinder support means and control means for adjustably controlling the pivot angle between said frame and said base.

12. The grinding apparatus of claim **11** wherein said control means comprises motor driven screw means.

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