

May 12, 1964

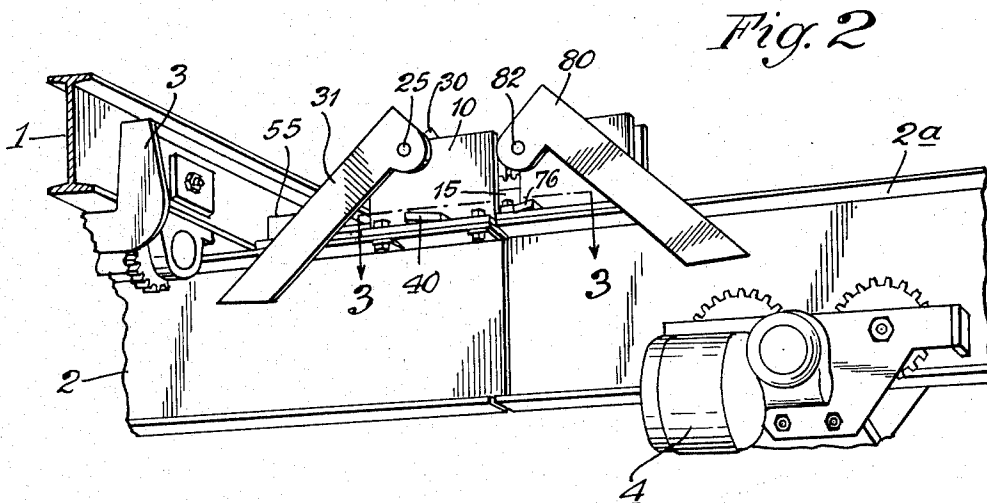
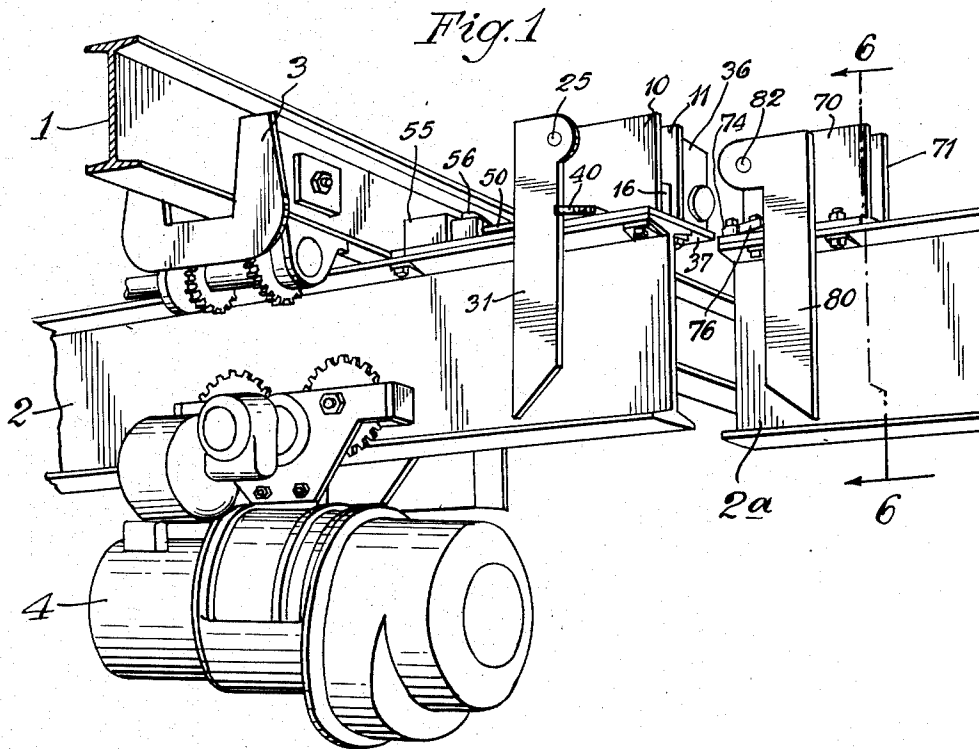
C. F. PEARSON

3,132,598

CRANE INTERLOCK MECHANISM

Filed Nov. 6, 1953

5 Sheets-Sheet 1



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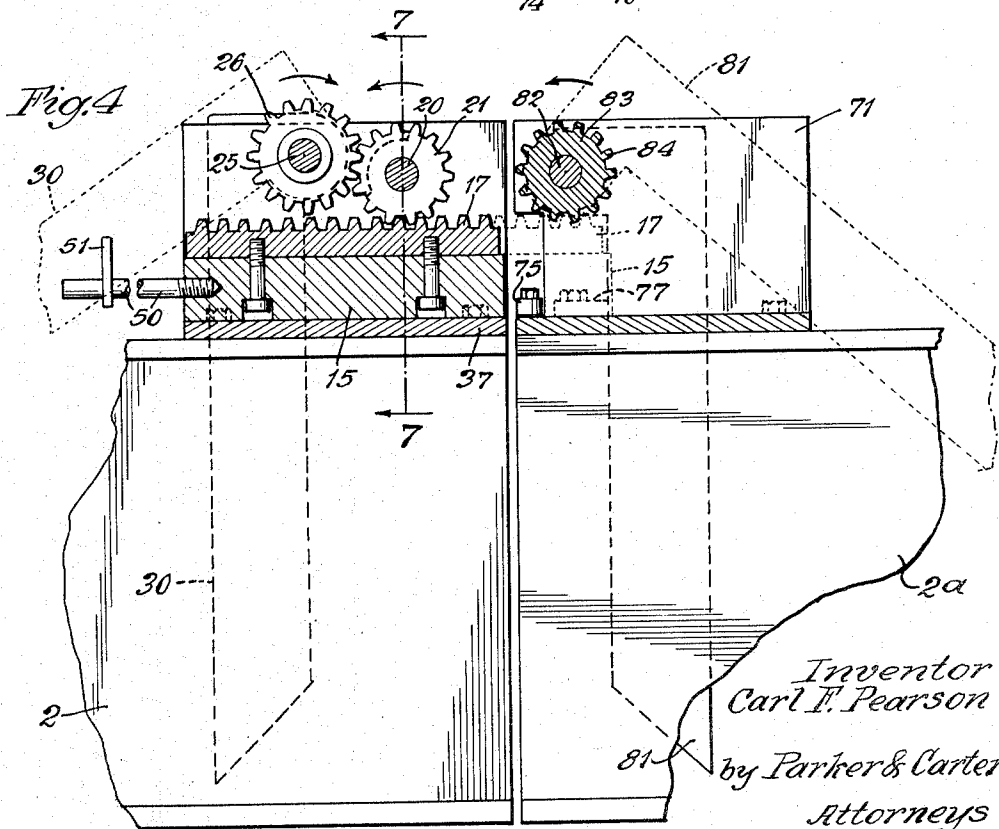
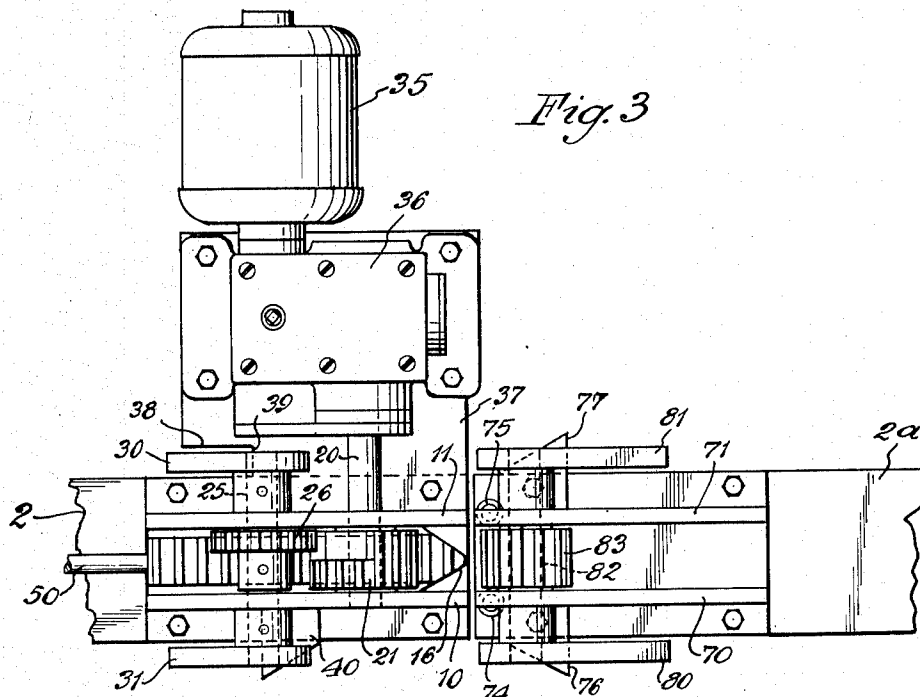
C. F. PEARSON

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CRANE INTERLOCK MECHANISM

Filed Nov. 6, 1953

5 Sheets-Sheet 2



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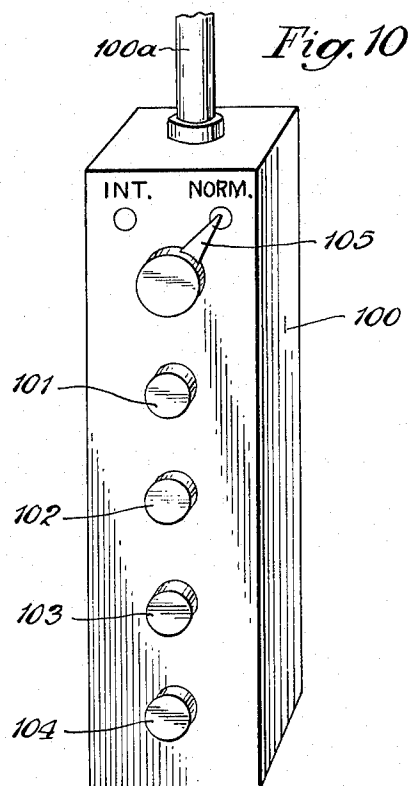
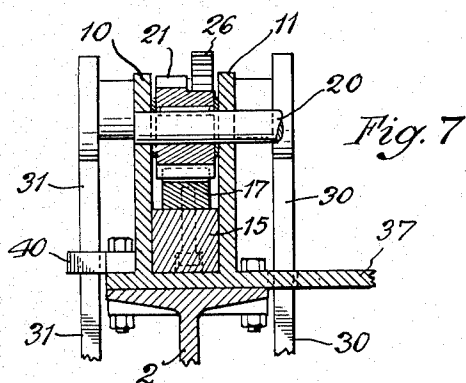
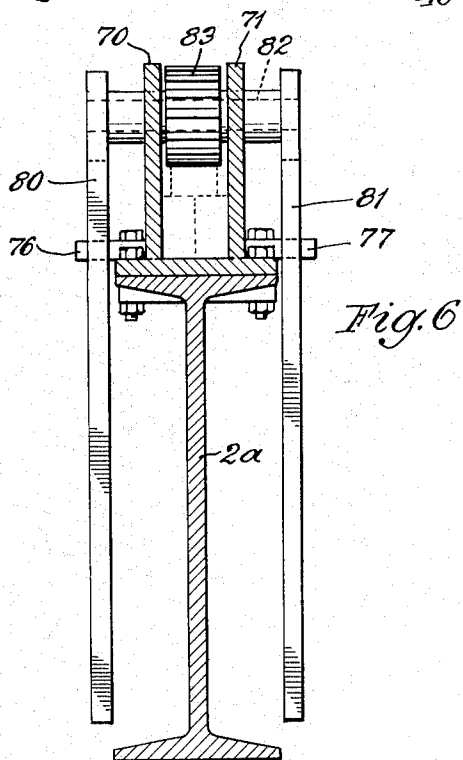
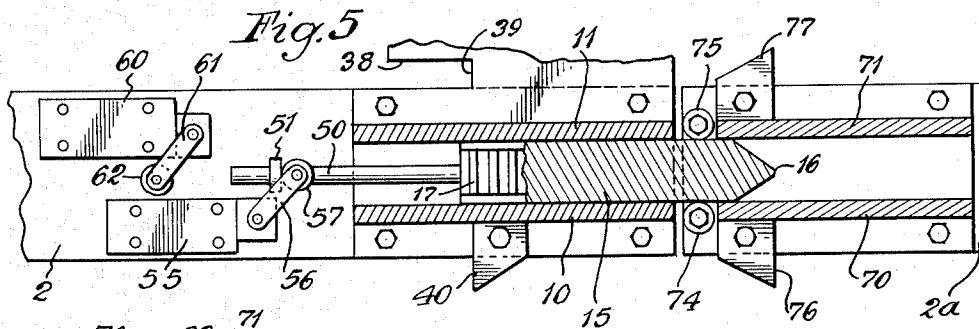
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3,132,598

CRANE INTERLOCK MECHANISM

Filed Nov. 6, 1953

5 Sheets-Sheet 3



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**May 12, 1964**

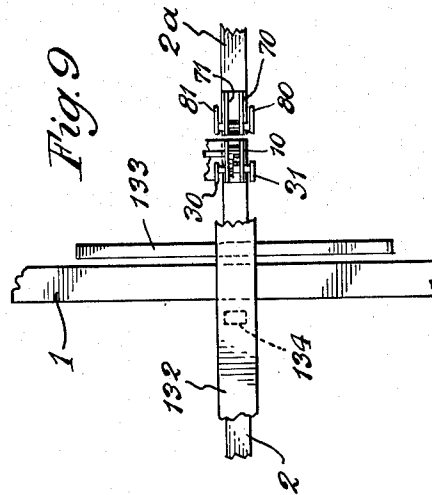
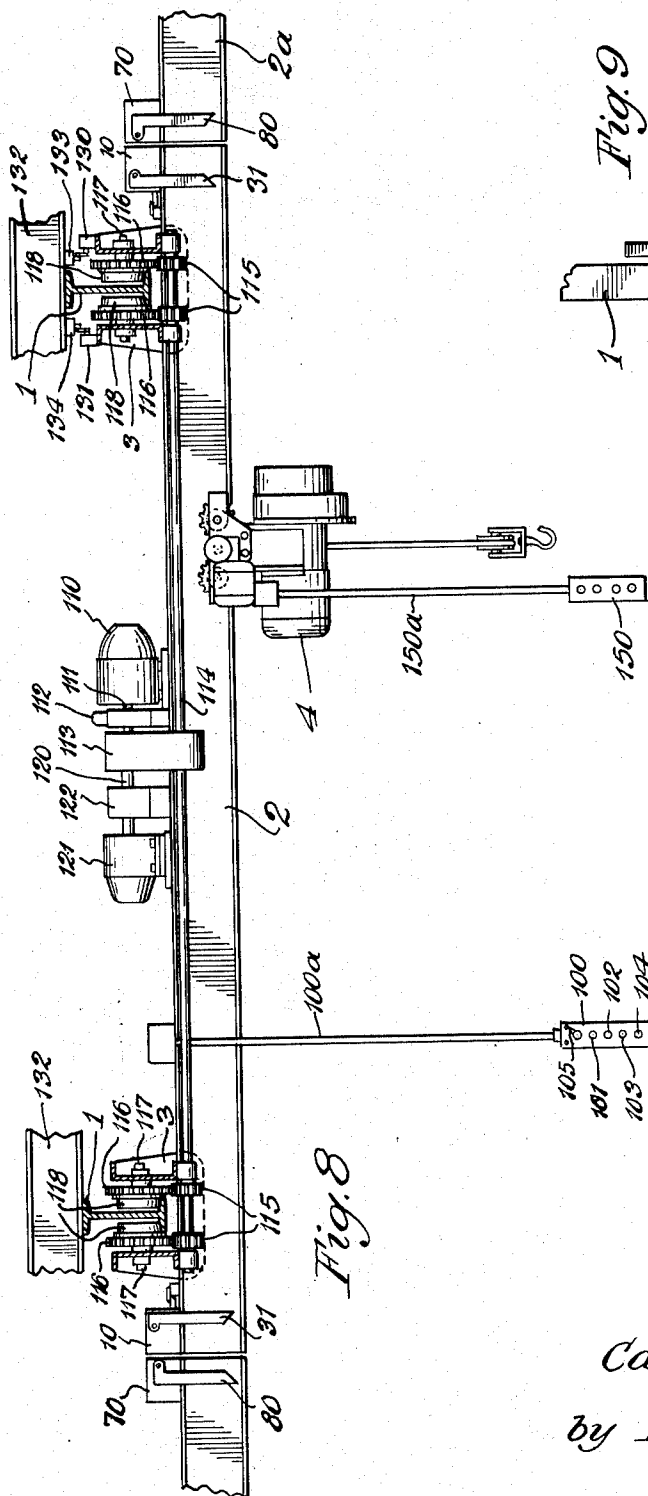
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**3,132,598**

## CRANE INTERLOCK MECHANISM

Filed Nov. 6, 1953

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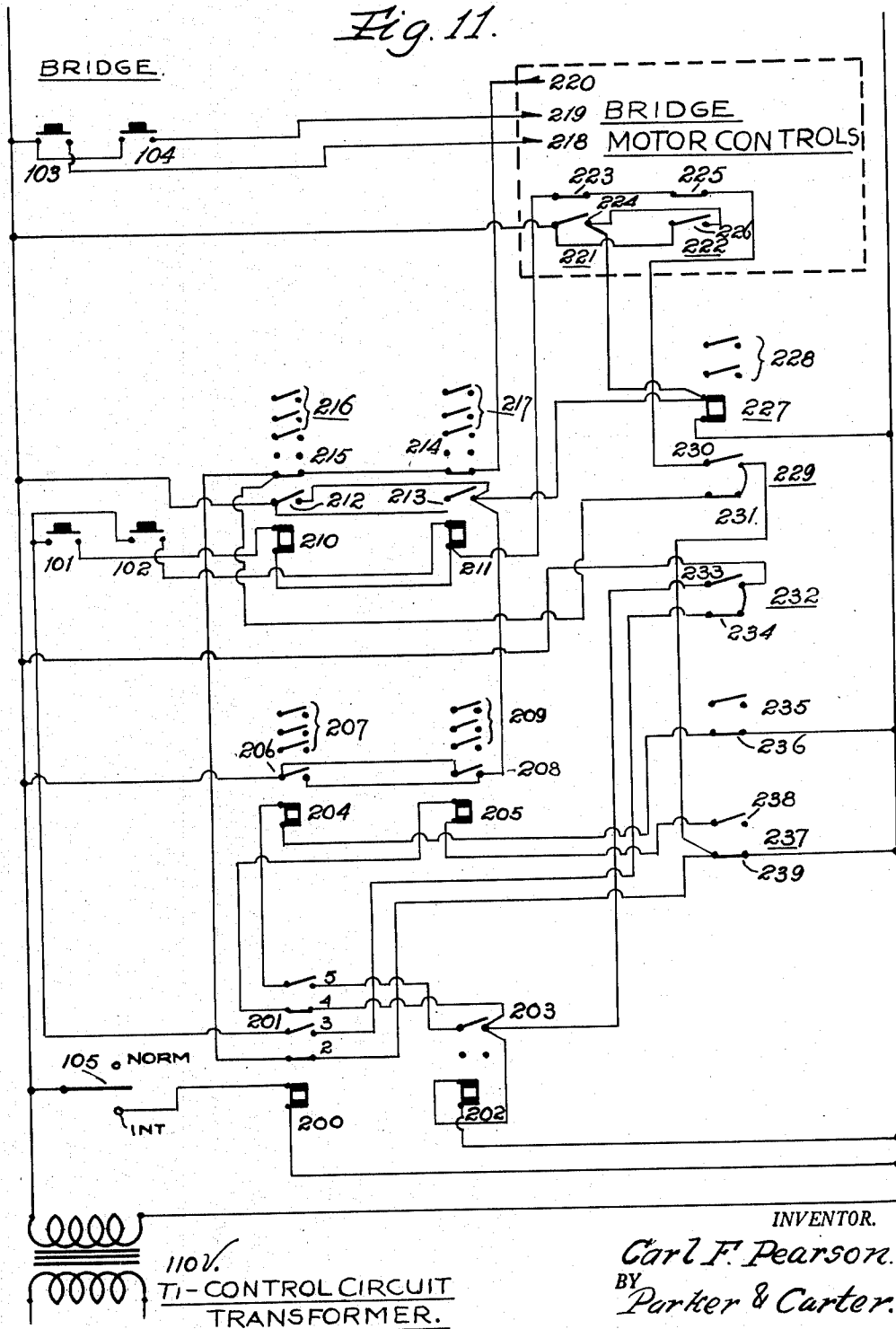
C. F. PEARSON  
CRANE INTERLOCK MECHANISM

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*Fig. 11.*



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3,132,598

## CRANE INTERLOCK MECHANISM

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Filed Nov. 6, 1953, Ser. No. 390,527  
8 Claims. (Cl. 104-98)

My invention relates to improvements in crane interlock mechanisms and comprises means for locking a transfer crane in alignment with the spur tracks that branch off from the crane runway on which the crane or hoist travels. While an electric crane hoist is illustrated in the drawings, it will be realized that the invention has application whether the item to be transferred from one set of tracks to another is a crane, a hoist, or other mechanism.

One purpose of my invention is to provide a structure of simplicity which shall be effective to securely and automatically lock a crane track in alignment with one or more branch trolley runways or spur tracks and to prevent the trolley or hoist from being run off the crane or connecting spur tracks unless the crane bridge is securely locked in perfect alignment with a spur track.

Another purpose is to provide a mechanism comprising trolley stops normally effective to prevent a trolley from running off the beam of a crane or off a spur track, which trolley stops are rendered inoperative automatically whenever the crane is locked to a cooperating spur track.

Another important purpose of my invention is to provide a crane interlock mechanism which, after engagement, cannot be disengaged unless the trolley stops provided for cooperation therewith have been returned positively to their trolley-stopping position.

Another purpose is to provide a crane bridge and control mechanism therefor which shall be effective to automatically reduce the speed of said bridge as it approaches a spur track or tracks and to automatically align said bridge and spur.

Other purposes will appear from time to time in the course of the specification and claims. My invention is illustrated more or less diagrammatically in the accompanying drawings wherein:

FIG. 1 is a side view illustrating a crane and spur track out of alignment one with the other, the trolley stop of my invention being in trolley-stopping position;

FIG. 2 is a side view illustrating a crane and spur track locked in alignment by means of the structure of my invention;

FIG. 3 is a top view, in partial cross-section, taken on the line 3-3 of FIG. 2 on an enlarged scale;

FIG. 4 is a side view in partial cross-section of a portion of the interengaging members forming a part of my invention;

FIG. 5 is a top view, in partial cross-section, illustrating the interengaging members forming a part of my invention and electrical control means associated therewith;

FIG. 6 is an end view, in partial cross-section, taken on the line 6-6 of FIG. 1;

FIG. 7 is a cross-sectional view taken on the line 7-7 of FIG. 4;

FIG. 8 is a side view, on a reduced scale, illustrating my bridge control and aligning mechanism;

FIG. 9 is a detail plan view showing the set of control cams employed;

FIG. 10 is a detail view, on an enlarged scale over that of FIG. 8, illustrating a bridge or crane control member; and

FIGURE 11 illustrates a conventional electric circuit usable with the structure of my invention.

Like parts are illustrated by like symbols throughout the specification and drawings.

Referring now to the drawings and particularly to FIG.

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1, a crane-supporting member or crane track, which may be an I-beam, is illustrated at 1. A crane 2 is movably supported from the track 1 as by the crane-supporting frame 3. The crane 2 may, like the support 1, be composed of an I-beam as may the run-off or branch trolley runway indicated at 2a. The crane 2 moves linearly of the track 1, and has its end portions extending substantially to either side of and perpendicularly to the track 1.

Generally indicated at 4 is a hoist which is movably supported on the crane 2 for travel linearly thereon. While an electrical chain hoist is illustrated in the drawings, it will be realized that whatever member is movably supported on the crane 2 the nature and scope of my invention is not effected thereby.

Mounted upon the upper flat surface of the crane 2 and vertically rising therefrom adjacent its end are wall members 10-11 which are parallel one to the other and are spaced apart. Slidably mounted for movement along the upper flat wall of the crane 2 and between the walls 10-11 is the plunger or latch member 15 having the tapering outer end portion 16. The plunger 15 carries along its top wall the rack 17. Rotatably mounted in the walls 10-11, as indicated at 20, is the toothed pinion member 21. As best illustrated in FIGS. 3 and 7, the pinion 21 has an arcuate segment of parts of some of the teeth thereof removed. It will be realized, however, that some portions of the teeth of the pinion 21 are engaged at all times with some of the teeth of the rack 17. Rotatably mounted between the walls 10-11, as at 25, is a second gear member 26. The teeth of the gear member 26 are arranged in the same plane as the toothless arcuate segment of the pinion 21. Thus it will be realized that the pinion 21 may turn through a portion of a revolution before the full teeth of the pinion 21 come into engagement with the teeth of the gear 26. Secured to the gear shaft 25 for rotation therewith and with the gear 26 are the trolley stop or abutment members 30-31 which are mounted outside the walls 10-11 for a distance sufficient to permit the end portions of said abutment members to extend downwardly substantially below the upper flat wall of the crane 2 upon which the walls 10-11 are mounted.

The shaft 20 is journaled in the walls 10-11 and is turned by the electric motor 35. Appropriate gearing between the motor means 35 and the shaft 20 may be supplied as indicated generally at 36. 37 is a support for the motor and gearing, which support 37 may consist of a base plate secured to the flat top wall of the crane 2. The plate 37 has a cut-out portion 38 spaced from the edge of the crane 2 to allow the abutment member 30 to pass therebetween and to create an abutment or stop means as at 39 for the purpose of limiting the downward travel of the trolley stop or abutment 30 beyond the vertical. A similar limiting means is illustrated at 40 for the trolley stop 31.

Referring now to FIG. 5, it will be seen that the plunger 15 carries the extension arm or rod 50 extending laterally from the rear face of the plunger. The rod 50 in turn carries the flange or enlargement 51. 55 is a limit switch having the contact or switch arm 56 which, through the roller 57, is in position to be contacted by the shoulder 51 on the rod 50 at one position in the travel of the rod 50 and plunger 15. 60 is a second limit switch having a similar arm 61 and roller 62 likewise arranged to be contacted by the shoulder 51 on the rod 50 in another position of travel of the plunger 15.

While I illustrate a single crane track and spur track, it will be realized that there may be a set of parallel crane tracks and a set of parallel spur tracks employed without departing from the nature and scope of my invention.

Referring generally now to the right-hand portions of FIGS. 1-5, it will be seen that the transfer runway or spur track 2a has secured to its upper flat surface a struc-

ture similar in outer appearance to that above described. Vertical spaced walls 70—71 are arranged to be in longitudinal alignment with the walls 10—11 when the crane 2 and trolley runway or spur 2a are themselves in alignment. As will be best seen from a view of FIG. 5, the walls 10—11 and 70—71 are spaced apart, one from the other, for a distance substantially equal to the width of the plunger 15. Similarly spaced apart for a distance substantially equal to the width of the plunger 15 are roller contact members or guide rollers 74—75. 76—77 are stops or limit means effective to limit the travel in one direction beyond the vertical of the trolley stops or abutments 80—81. It will be realized that the trolley stops 30—31 and 80—81 may be identical in overall shape and size. The abutments 80—81 are arranged outside the walls 70—71 and are secured to a transverse shaft 82 which is rotatably mounted in the walls 70—71. As best illustrated in FIGS. 3 and 4 a gear member 83 is secured to the shaft 82 between the walls 70—71. The gear 83 has the teeth 84 for engagement with the rack 17 on the plunger 15 when the plunger enters between the walls 70—71. It will be realized that the control or limit switches 55, 60 are connected, through appropriate electrical circuits, with means controlling the movement of the crane 2 and plunger 15.

While the various elements of the present invention are shown as associated with the right-hand portion of a crane, it will be understood that they may be positioned in relation to either or both ends thereof.

Referring now to FIG. 8, I illustrate a bridge control mechanism, including means for reducing the speed of the bridge as it approaches a spur track and for facilitating alignments of the bridge with such spur runway. The numeral 100 indicates a pendant bridge control or switch which may depend from the bridge as by the electrical conduit 100a. It will be realized that the electrical conduit 100a includes appropriate electrical connections to the bridge motor below described. The switch 100 includes manually operable push buttons 101—104, also below described. The control 100 may also include the selector switch 105, which may be of the two-position throw or toggle type.

The electrical conduit 100a leads, through appropriate electrical connections, to the bridge motor 110. The bridge motor 110 has an external shaft 111 with which may be associated the solenoid brake 112. A gear or speed-reduction device is indicated at 113 as being associated with the shaft 111. Associated with the gear reduction 113 is the bridge-driving shaft 114 which carries at each end a pair of driving gears 115. The gears 115 are in mesh with gears 116 which are in turn secured to the shafts 117 on which are fixed the bridge wheels 118. As will be seen from a view of FIG. 8, the wheels 118 rest each upon opposite sides of the crane support 1, and the wheel shafts 117 are secured to the vertical sides of the frame 3 on which the bridge or crane 2 is secured. Thus it will be seen that operation of the bridge motor 110 causes, through the gear reduction box 113, shaft 114, gears 115 and 116, rotation of the wheels 118 and consequent movement of the crane 2 along the supporting track 1. A shaft 120 extends from the opposite side of the gear reduction box 113 and is driven by a second motor, commonly known as an "inch" motor, 121. Associated with the shaft 120 is an electromagnetic clutch 122. It will be realized that the electrical conduit 100a is also connected, through appropriate electrical circuits, to the inch motor 121 and clutch 122.

Secured to an upper edge of one vertical wall of the frame 3 is a switch 130 which may be called an inch motor control switch. Secured to an upper edge of the opposite vertical wall of the frame 3 is a second switch 131 which may be known as a limit or alignment switch. Shown in broken view in FIG. 8 is a member 132 to which the bridge runway or supporting track 1 is secured. It will be realized that the member 132 may constitute any

appropriate structure in the building in which the crane mechanism is installed, and that the member 132 is fixed in position. Secured to the member 132, in position to be contacted by the switch 130 is the cam 133. Likewise secured to the member 132 is a second cam 134 positioned to be contacted by the switch 131. It will be realized that the switches 130, 131 have associated therewith appropriate cam-contacting arms and rollers similar to those illustrated at 56, 57 and 61, 62, as shown in FIG. 5. The cam 133 is substantially longer than cam 134 and extends parallel with the track 1 for a distance to either side of spur 2a. The cam 134 is in general alignment with the spur 2a. While two cams and two switches are shown, it will be clear that one cam, suitably formed, and one switch, having a number of contact points, may be employed.

The push button 101, when operated, causes the inch motor 121 to produce forward motion of the crane 2. The push button 102 similarly causes the inch motor to produce reverse movement of the crane. Likewise the push button 103 actuates the bridge motor to cause forward motion of the crane 2 and push button 104 actuates the bridge motor to cause the reverse movement of the bridge 2. It will be realized that the bridge motor is arranged to drive the crane 2 at a greater speed than that at which the inch motor will drive the crane 2. For example, the bridge motor may cause movement of the crane 2 at the rate of, say, 150 feet per minute while the inch motor may, for example, cause movement of the crane 2 at the rate of 10 feet per minute.

The selector switch 105 has, as indicated above, two positions. The right-hand position of the selector switch 105 may, for example, be labeled the "normal" position while the left-hand position may be labeled the "interlock" position.

FIG. 8 shows a manually operated control switch 150 which depends from and is suitably connected, as by the conduit 150a, to the hoist 4. It will be realized that the control of the hoist 4 is entirely separate from the control of the crane 2.

It will be realized that whereas I have described and illustrated a practical and operative device, nevertheless, many changes may be made in the size, shape, number and disposition of parts without departing from the spirit of my invention. I, therefore, wish my description and drawings to be taken as in a broad sense illustrative or diagrammatic, rather than as limiting me to my precise showing.

The use and operation of my invention are as follows:

When the operator desires to transfer a mechanism, such as the electrical chain hoist 4 from a crane, such as the crane 2, he must first cause the crane 2 to be brought into general alignment with the runoff runway 2a. To do this, as the crane approaches the spur track 2a, the operator will flip the selector switch 105 to "interlock" position. This action serves to energize the cam switches 130—131 and to set up the automatic control circuits required to produce alignment and interlock automatically. While normally operating along the track 1 the operator uses the push buttons 103, 104 to cause movement of the crane 2, it is no longer necessary for him to do so after he has moved the selector switch 105 into "interlock" position.

As the crane approaches the run-off spur 2a the switch arm of the switch 130 is brought into engagement with the cam 133 which, as above described, is of substantially longer extension along the line of travel of the crane 2 than the short cam 134, the cam 133 extending to either side and perpendicularly of the spur 2a. Actuation of the switch 130 by contact with the cam 133 causes the bridge motor 110 to be cut out of the circuit and to stop and at the same time brings the inch motor 121 into the circuit which causes a consequent reduction in speed of the crane 2 from whatever speed at which it was being driven by the bridge motor to a very slow speed, of the

order of say 10 feet per minute. It will be realized that actuation of the switch 130 caused engagement of the electromagnetic clutch 122 to bring the inch motor into control of the crane 2. As the inch motor 121 brings the crane 2 gradually toward a position of alignment with the spur 2a the switch 131 is brought into contact with the short cam 134. Actuation of the switch 131 causes, through appropriate electrical connections, the inch motor to stop and causes the solenoid brake 112 to set, thus automatically stopping the crane in a position of general alignment with the spur 2a. Through appropriate automatic time delay circuits the bridge brake 112 is released after only a momentary period of operation, in order to permit slight adjustment of the crane 2, and the interlock motor 35 is automatically started, all as a result of the actuation of the switch 131 by the cam 134. Energizing of the interlock motor 35 causes movement of the plunger forward into the interlock keeper walls 70—71. The forward motion of plunger 15 permits switch 60 to operate to cut out the supply of electric energy to either the bridge or inch motor and between these and the selector switch 105. As below described, movement of the plunger 15 between the walls 70—71 causes actuation of the switch 55 which is effective to shut off current to the interlock motor when the plunger has reached its limit of forward travel. Actuation of the switch 55 also causes a resetting of the brake 112 which is allowed to remain set so long as the selector switch 105 remains on "interlock" position.

When the operator desires to disengage the crane 2 from the spur track 2a, it is only necessary for him to flip the selector switch into "normal" position. This action causes a reverse movement of the interlock motor 35 to return the plunger into retracted position. When the plunger has fully returned it will actuate switch 60, as illustrated in FIG. 5, which is effective to release the brake 112 and to reset the bridge circuit for normal operation through the control 100.

Referring to the interlock mechanism itself, the motor 35 through the gearing 36 rotates the shaft 20 and the gear 21 secured thereto. As the gear 21 is rotated in the direction shown by the arrow in FIG. 4, the teeth of the gear 21 being in engagement with those of the rack 17 on the plunger 15 cause the plunger 15 to enter between the walls 70—71 on the runoff or spur trolley 2a. As the tapered end 16 of the plunger 15 approaches the walls 70—71 it will, if not exactly centered between them, first contact the guide rollers 74—75. Thus, even though the crane may not have been aligned absolutely perfectly, the action of the tapered end 16 and the roller 74—75 is effective to center the plunger 15 between the guide rollers 74—75 and consequently between the walls 70—71 and thus to minutely align the tracks.

Since that portion of the gear 21 which is in alignment with the gear 26 has a portion of its teeth removed, the initial rotation of the pinion 21 in the direction of the arrow in FIG. 4, does not cause a rotation of the gear 26 but only a sliding movement of the plunger 15. When the plunger 15 has entered between the walls 70—71, however, the continued rotation of the pinion 21 brings the full length teeth which have portions in alignment with the gear 26 into engagement with the teeth of the gear 26 causing rotation of that gear and its shaft 25 and a consequent rotation of the abutment members 30—31 in a direction of the arrow in FIG. 4, i.e., upwardly out of the path of the crane hoist 4.

When the plunger 15 with its rack 17 enters between the walls 70—71 and passes the roller 74—75 the teeth of the rack 17 are brought into engagement with the teeth of the gear 84 causing rotation of said gear in the direction of the arrow in FIG. 4 and a consequent rotation of the shaft 82 and trolley stops 80—81, thus raising said trolley stops upwardly out of the path of a chain hoist, such as that illustrated at 4. It will be apparent from a view of FIG. 4 that the delay in contact between the teeth

of the pinion 21 and those of the gear 26 is effective to produce movement of the four trolley stops 30—31, 80—81 simultaneously. When the plunger 15 has entered between the walls 70—71 the crane 2 and runoff runway 2a has been locked securely in perfect alignment one with the other, the trolley stops or abutments 30—31, 80—81 have been rotated upwardly out of the path of the chain hoist 4 and the chain hoist may then be safely transferred from the crane 2 to the runoff or spur runway 2a.

In the past various crane-locking mechanisms have been provided but experience has indicated that difficulties persist. It should be realized that often many cranes and hoists are normally operated simultaneously over many runways and cranes throughout a plant. As an example of one such difficulty, there have been occasions when a mechanism, such as the chain hoist 4, has been left adjacent the end of a runoff runway such as that illustrated at 2a, while the crane and runoff runway were in alignment and were locked together. Thereafter someone has come along and unlocked the crane moving it to another position. The stop means provided for the runoff runway could not be then brought into trolley stopping position since the chain hoist or trolley was blocking this position. Thereafter it was not long before someone came along and caused the chain hoist to run off the open end of the runway 2a. As will be best seen perhaps in FIG. 2, such as a result is impossible with the structure of my invention. Should the chain hoist 4 be in a position such as to interfere with the downward travel of the abutments 80—81 or 30—31 into runway closing position, the abutments would be brought into contact with the chain hoist. As soon as that happened it would be thereafter impossible to rotate the abutments or their shafts 82—25 or the gears 84—26 on said shafts. Since the gear 84 is in engagement with the rack 17 on the plunger 15 it would be likewise impossible to withdraw the plunger 15 and therefore impossible to unlock the crane 2 from the runoff runway 2a until such time as the chain hoist 4 was moved securely into a safe position on one or the other and thus out of a position blocking movement of the abutments 30—31, 80—81, at which time only the bridge drive mechanism is again rendered operative.

It is impossible to withdraw the plunger 15, and thus impossible to separate the tracks 2, 2a, unless the abutments 80—81 and 30—31 are caused to enter trolley-stopping position, since each are in mesh with the plunger rack 17. Thus retraction of the plunger 15 automatically and positively pulls down the abutments 80—81 and 30—31. Thus rusting or distortion of the various parts cannot cause the abutments to remain up out of trolley-stopping position after separation of the tracks 2, 2a but, on the contrary, any such rust or distortion sufficient to cause such sticking would either be overcome and the abutments lowered or would prevent separation altogether. There follows a description of a conventional wiring circuit and its employment in connection with my invention.

Referring now to FIGURE 11, the two-way control switch 105 is illustrated in the lower left-hand portion thereof. 200 is a control relay operated by switch 105. 201 generally illustrates a series of contacts associated with the relay 200. 202 is a timing relay controlling a delayed closing operation. 203 illustrates contacts on the timing relay 202. 204 is an interlock motor forward control relay employed in driving motor 35. 205 is an interlock motor retraction control relay employed to drive the motor 35 in a reverse direction. 206 illustrates a contact associated with the relay 204, and 207 illustrates three contacts associated with relay 204 to supply power to the motor 35. 208 and 209 are contacts associated with the retraction control relay 205. 101 and 102, as previously indicated, designate the inch motor forward and reverse control buttons or switches, respectively. 210 and 211 designate the inch motor forward and reverse control relays, respectively. 212 is a contact for the

inch motor forward control relay, and 213 is a contact for the inch motor reverse control relay. 214 is another contact for the inch motor reverse control relay. 215 is a contact for the inch motor forward control relay. The contacts 212, 213 are normally open, while the contacts 214, 215 are normally closed. 216 and 217 illustrate banks of contacts for the inch motor forward and reverse control relays, respectively, and are employed to supply forward and reverse drive to the inch motor. 103 is a bridge motor forward push button or switch. 218 is a conductor to the bridge motor forward control relay. 104 is a bridge motor reverse push button or switch, and 219 is a conductor to the bridge motor reverse control relay. 220 indicates a common-return conductor from the bridge control relays. 221, 223, 224 are contacts for the bridge motor forward control relay, and 222, 225, 226 are contacts for the bridge motor reverse control relay, the contacts 223, 225 being normally closed and the contacts 224, 226 being normally open. 227 is a control relay for the bridge brake 112 and 228 is a pair of contacts on the brake control relay 227 to supply brake-releasing power. 229 is a limit switch effective to cut off power to the bridge motor control. 230 is a normally open contact on switch 229, and 231 is a normally closed contact on switch 229. 232 is a second limit switch effective to cut off power to the inch motor controls. 233 is a normally open contact on switch 232, and 234 is a normally closed contact on switch 232. 235 is a third limit switch effective to cut off control power from the interlock motor forward control. 236 is a normally closed contact on switch 235. 237 is a fourth limit switch effective to cut off control power to the interlock motor retraction controls. 238 is a normally open contact on switch 237, and 239 is a normally closed contact on switch 237.

The crane bridge is operated with the switch 105 in the "normal" position, and the limit switches 229, 232, 235, 237 are rendered ineffective. When it is desired to transfer the hoist 4 from the bridge to a spur, the switch 105 is turned to "interlock" position. The relay 200 is thereby energized, the contacts 201-3, 201-5 are closed and the contacts 202-2, 201-4 are open. If the crane is not in the area of a spur, however, nothing else happens, and the bridge continues to operate normally. If the crane is, on the other hand, operating in an interlocking area or approaches the spur track, cams such as the cam 133 are effective to trip appropriate limit switches in order to set in motion the automatic interlocking sequence.

With the switch 105 in "interlock" position, the control buttons 101-104 are operated in the same manner as they would be under normal operation. However, when the crane bridge passes into the interlocking area, the limit switch 229 is tripped, thus opening contact 231, cutting off power to the bridge motor control and applying the brake 112. The inch motor button 101, 102 is then depressed and a circuit is established through contacts 234, 201-3, the inch motor 121, push button 101 or 102 and the inch motor relay 210 or 211, contacts 223, 225, 230, and 239. The inching motor contacts 216 or 217 supply power to the motor 121 and the magnetic clutch 122 to cause a coupling of the motor 121 at the crane bridge drive gear reducer 113. Thereafter, the inch motor 121 continues to propel the crane bridge at slow speed toward the interlock position at which point a second cam on the runway beam trips the limit switch 232, opening contacts 231 and closing contact 230. The inch motor control circuit is thus broken, the magnetic clutch 132 is de-energized, and the brake 112 is applied to prevent the crane bridge from closing beyond the mating or interlocking position. The timer 202 is simultaneously energized, which provides a five-second interval for the bridge to reach a complete stop before commencement of further events in the automatic interlocking sequence. After the five-second period, the timer 202 closes contacts 203, completing the circuit through contact 201-5 to the interlock motor forward control relay 204 and contact

236 of the limit switch 235. When the coil or relay 204 is energized, contact 206 is closed, releasing the bridge brake 112 to permit adjusting movement of the bridge during the final interlocking step. Also, when the relay 204 is energized, the contacts 207 are closed to supply power to the interlock motor 35, causing the interlock plunger 16 to move outwardly to engage with its mating unit on the stationary monorail spur. As the beveled point of the plunger seeks full alignment and is aided therein by the rollers 74, 75, the bridge is free to roll in response to the plunger displacement and insures perfect alignment of the bridge with the spur. When the plunger has been driven home and the baffles 30, 31, 80, 81 moved upwardly, the limit switch 235 is tripped, opening the contact 236 and breaking the circuit to the interlock motor and the bridge brake 112, de-energizing the relay 204 and opening contacts 206, 207. The limit switch 237 is also tripped, opening the contact 239 and closing the contact 238, thus preventing operation of the bridge controls. Thus, the crane bridge is now fully and completely interlocked with the monorail spur, the hoist baffles are moved out of the way, and the bridge crane being operated.

To thereafter separate the bridge from the spur, the operator returns the switch 105 to "normal" position, thus de-energizing the relay 200, opening contacts 201-3, 201-5 and closing contacts 201-2, 201-4. When the contact 201-4 is closed, the interlock motor retraction relay 205 is energized and contacts 208, 209 are closed. This causes the interlock motor 34 to begin withdrawal of the plunger and simultaneous downward motion of the interlock baffles. The bridge brake 112 also releases, allowing free motion of the plunger. When the plunger has been almost completely withdrawn and the baffles are therefore almost completely down, the limit switch 237 is released, thus opening the contact 238 and closing the contact 239. When the contact 239 is closed, it becomes possible to operate the bridge motor controls through the contacts 221, 222 once again. The bridge is then operated normally under control of the operator, the limit switches being rendered ineffective.

So long as the switch 105 is in the "normal" position, the inching motor and interlock motor cannot be operated. Similarly, when the automatic interlocking sequence is in operation, the bridge may not be operated. Thus, I provide a particularly safe and effective interlocking mechanism and controls.

I claim:

1. An interlock mechanism for relatively movable crane tracks comprising a plunger slidably mounted on one of said tracks, a rack on said plunger, a driving pinion in mesh with said rack, means for driving said pinion, a gear in mesh with said pinion during a portion only of the rotation thereof, a trolley stop mounted for movement into and out of trolley-stopping position in response to movement of said gear, a plunger keeper mounted on the other of said tracks, a second gear on said second named track mounted for engagement with said rack and for rotation in response to the movement thereof, and a trolley stop on said second track mounted for movement into and out of trolley-stopping position in response to rotation of said second gear.

2. An interlock mechanism for relatively movable crane track sections, including a pair of spaced apart vertical wall members on one of said track sections, a plunger slidably mounted on said track section between said wall members for movement parallel with and outwardly beyond said wall members, a rack on said plunger, a pinion rotatably mounted between said wall members and having teeth engaging said rack, electric motor pinion-driving means on said track section, a shaft rotatably mounted in said wall members, a gear secured to said shaft for rotation between said wall members, a pair of trolley stops secured to opposite ends of said shaft for rotation therewith into and out of trolley-stopping position adjacent opposite sides of said track section,

a second pair of vertical wall members on the other of said track sections spaced apart sufficiently to permit the entrance of said plunger therebetween, a second shaft rotatably mounted between said second wall members, a gear secured to said shaft for rotation therewith between said second walls and having teeth positioned for positive engagement with said rack upon the entrance of said plunger between said second walls to cause rotation of said gear and shaft, and an additional pair of trolley stops secured to said shaft for rotation therewith into and out of trolley-stopping position on either side of said second track section.

3. The structure of claim 2 characterized by a pair of circuit-controlling switches positioned on said first track, and means on said plunger for actuating said switches upon movement of said plunger into or out of track interlocking position to control the circuit.

4. In a crane structure, a movable crane, a first crane-moving means adapted to move said crane at one speed, a second crane-moving means adapted to move said crane at a slower speed, braking means adapted to halt the movement of said crane, and means for automatically positioning said crane at a predetermined position, said last-named means including a first cam fixed in relation to said predetermined position, a first switch movable with said crane adapted to be actuated by contact with said first cam and upon contact to transfer movement of said crane from said first-named crane-moving means to said second-named crane-moving means, and a second cam fixed in relation to said predetermined position, a second switch movable with said crane and adapted to be contacted by said second cam, said second switch being interconnected with said second crane-moving means and said brake, whereby upon being energized said crane-moving means is deenergized and said brake is applied when said crane has reached said predetermined position.

5. The structure of claim 4 characterized by and including means for locking said crane in said position in alignment with a spur track, including a plunger movable on said crane and adapted to penetrate a keeper on said spur track, plunger-moving means, and a connection between said second-named switch and said plunger-moving means adapted upon energizing said switch to cause said plunger-moving means to move said plunger outwardly toward said keeper.

6. The structure of claim 5 characterized by and including a time-delay mechanism connected with said brake whereby said brake is applied momentarily when said crane reaches said predetermined position, and a switch actuable by said plunger and connected with said brake whereby said brake is reapplied when said plunger has entered said keeper.

7. In an electric motor operated crane mechanism wherein a brake is applied to the motor in the absence of operating current thereto, the improvement comprising a combination therewith of means providing an alignment and locking engagement of said crane mechanism with a stationary spur track, a switch mounted on and movable with said crane mechanism in position to contact and be

operated by a cam when said crane mechanisms has reached a position of general alignment with said spur track, said switch being electrically connected to said crane-operating motor to apply said brake when said crane reaches said position, a plunger movable on said crane, a keeper housing on said spur track adapted to receive said plunger, plunger moving means on said crane, an electrical connection between said switch and said plunger moving means adapted upon the actuation of said switch to cause outward movement of said plunger toward said plunger-keeper housing, and a second switch associated with said plunger and positioned to be actuated by said plunger during the early portion of this outward movement, an electrical connection between said second switch and said crane-operating motor adapted to release said brake to permit slight adjustment of said crane in relation to said spur track and in response to the outward movement of said plunger under the influence of said plunger-moving means, whereby said plunger is permitted to seek alignment within said plunger-keeper housing to thereby cause accurate alignment of said crane with said spur track.

8. In a crane mechanism, a movable crane, a first motor adapted to move said crane at one speed, a second motor adapted to move said crane at a slower speed, braking means associated with said crane, manually operable switch means adapted to control said first motor, means for automatically positioning said crane including a manually operable selector on said switch means, a first switch movable with said crane, a second switch movable with said crane, a plunger on said crane adapted to enter a keeper on a spur track, plunger-moving means on said crane, an electrical connection between said first switch and said motors, an electrical connection between said second switch and said second motor, said second switch and said braking means, and between said second switch and said plunger-moving means, a first cam positioned in relation to said spur and in position to actuate by contact said first switch, a second cam positioned in relation to said spur and to actuate by contact said second switch, and switch means associated with said plunger and adapted in response to the outward movement of said plunger to break the circuit to said motors and to apply said brake, and a time-delay mechanism associated with said second switch and said plunger-moving means whereby said braking means is set only momentarily in response to actuation of said second switch and thereafter releases to permit slight adjustment of said crane in response to outward movement of said plunger under the influence of said plunger-moving means.

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