

Sept. 19, 1961

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3,000,099

SYSTEM OF ALIGNING RAILROAD TRACK

Filed Dec. 31, 1958

6 Sheets-Sheet 1

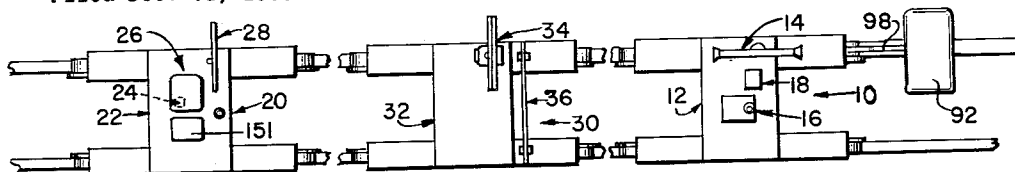


Fig. 1.

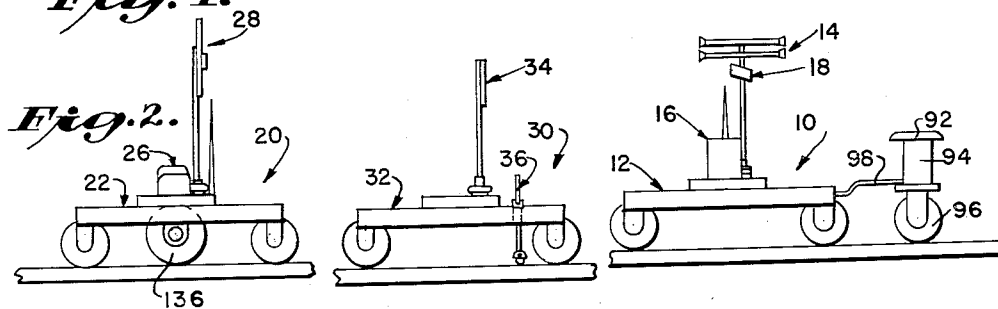
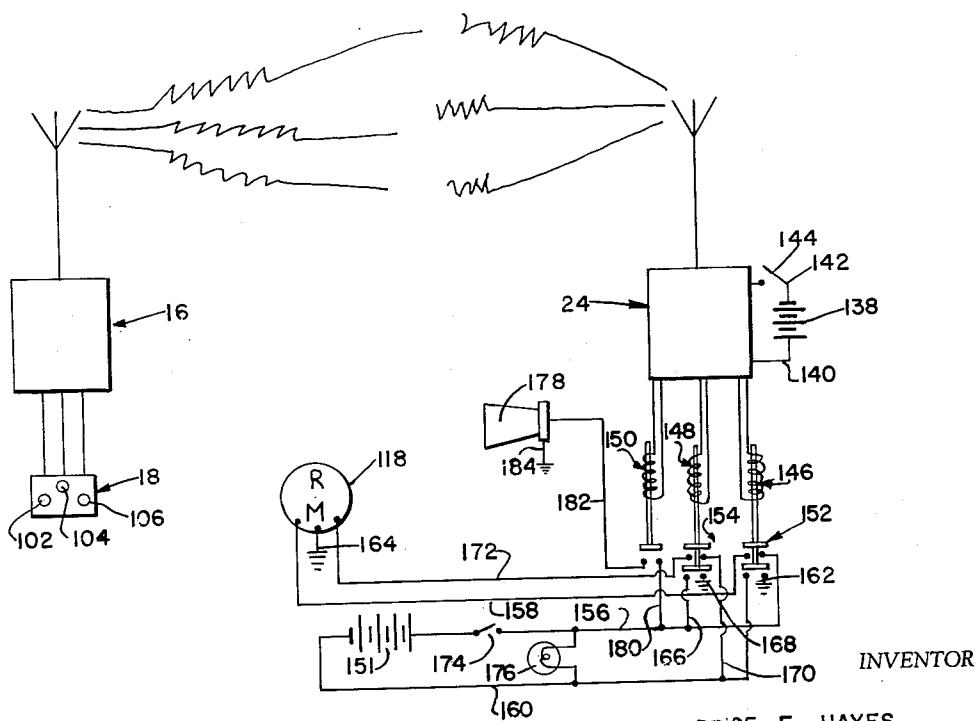


Fig. 2.

Fig. 8.



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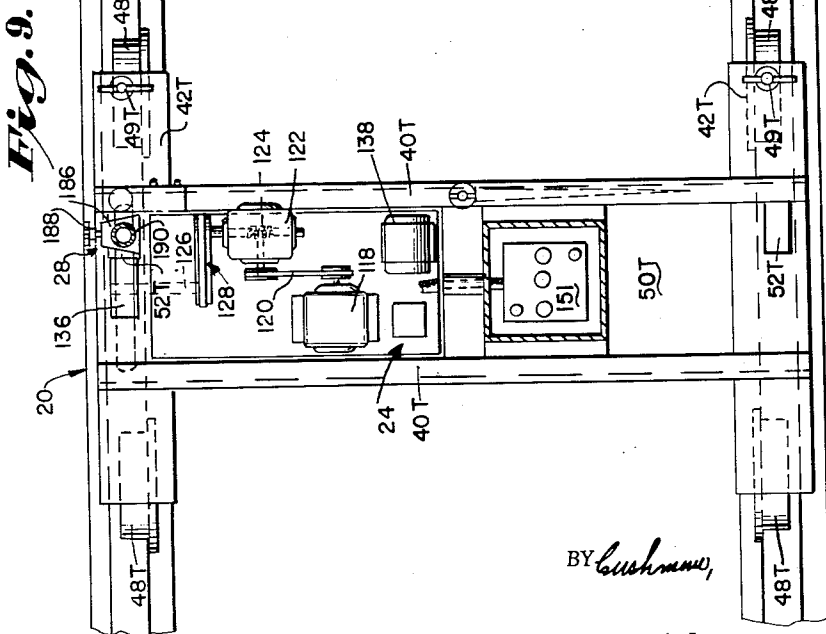
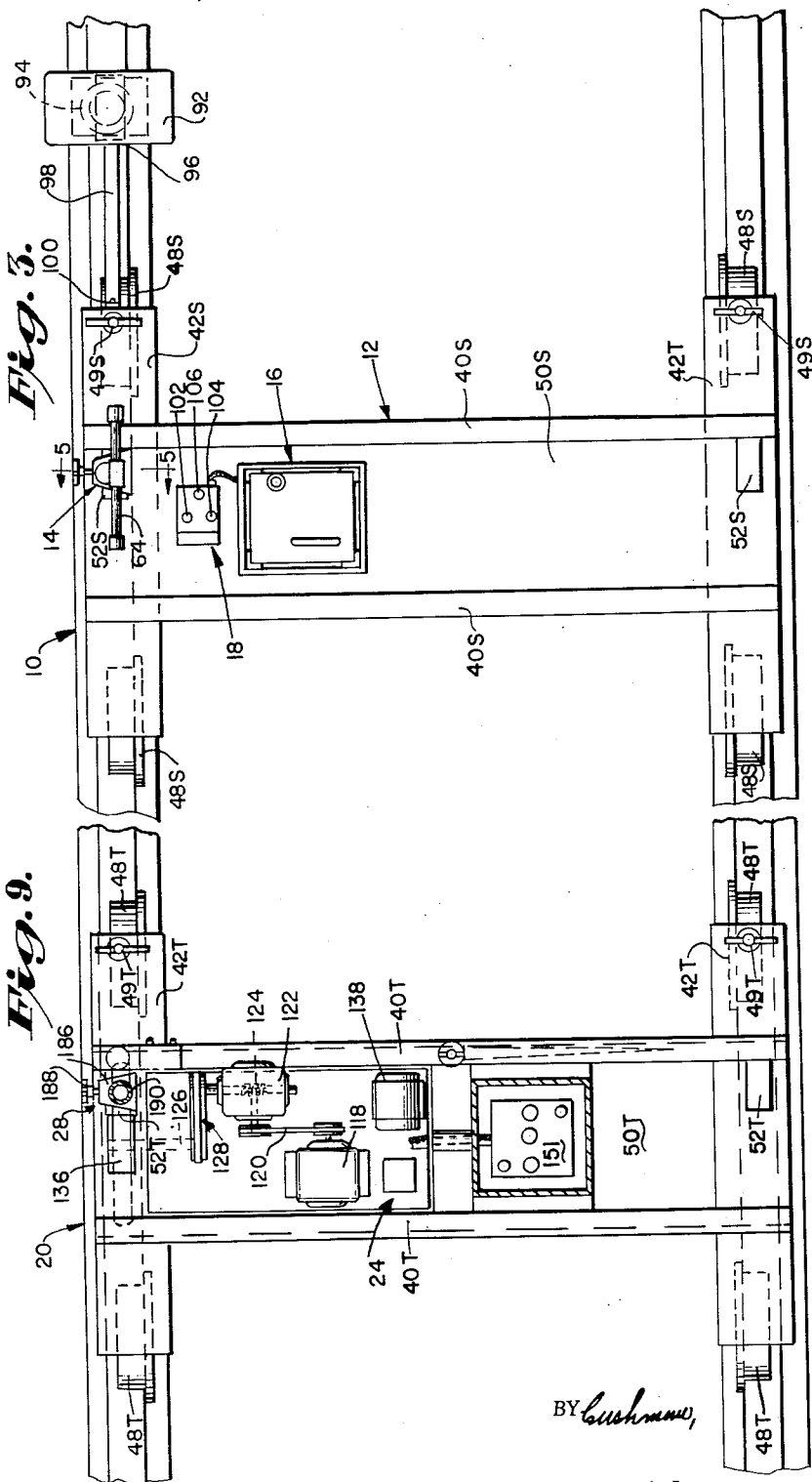
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6 Sheets-Sheet 2



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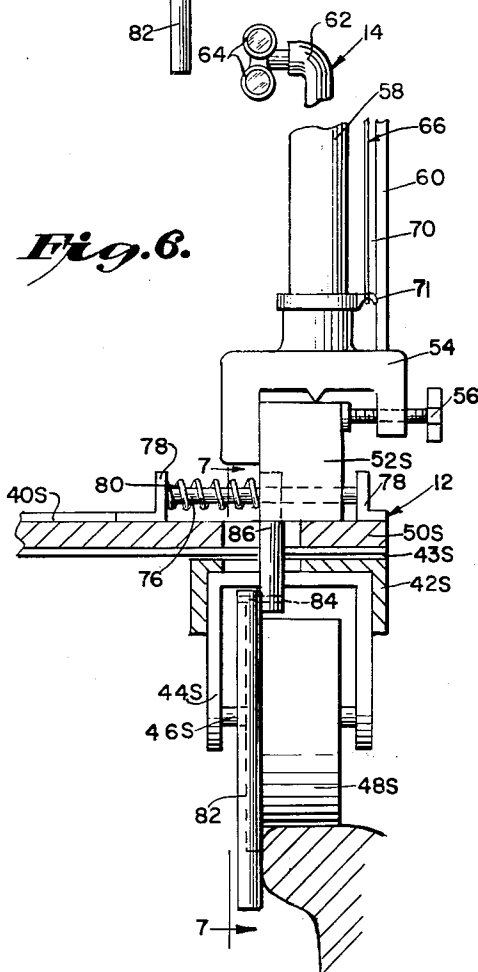
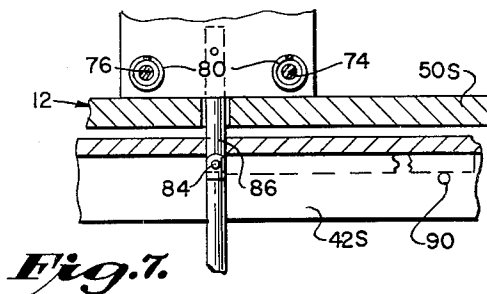
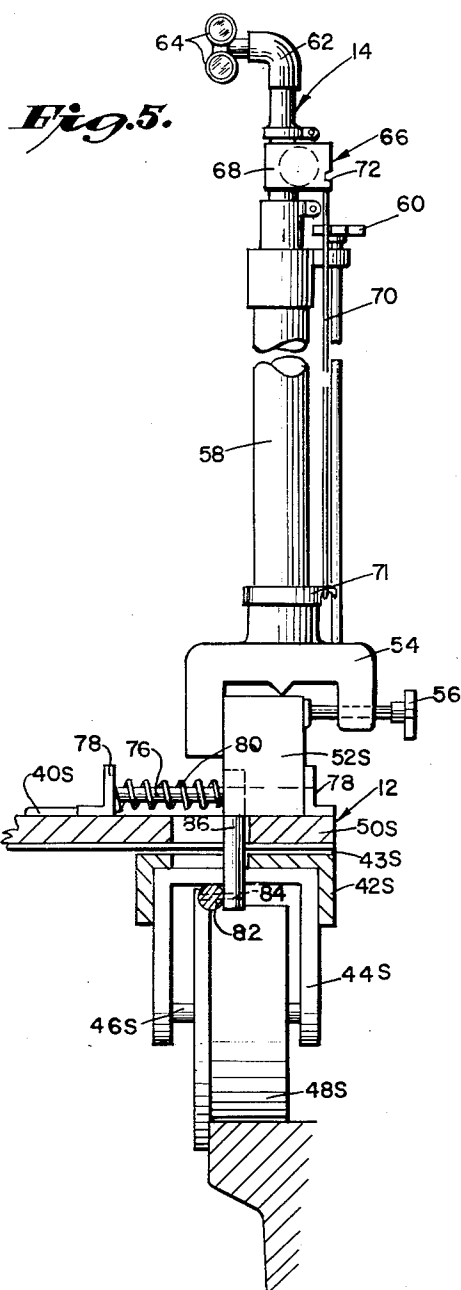
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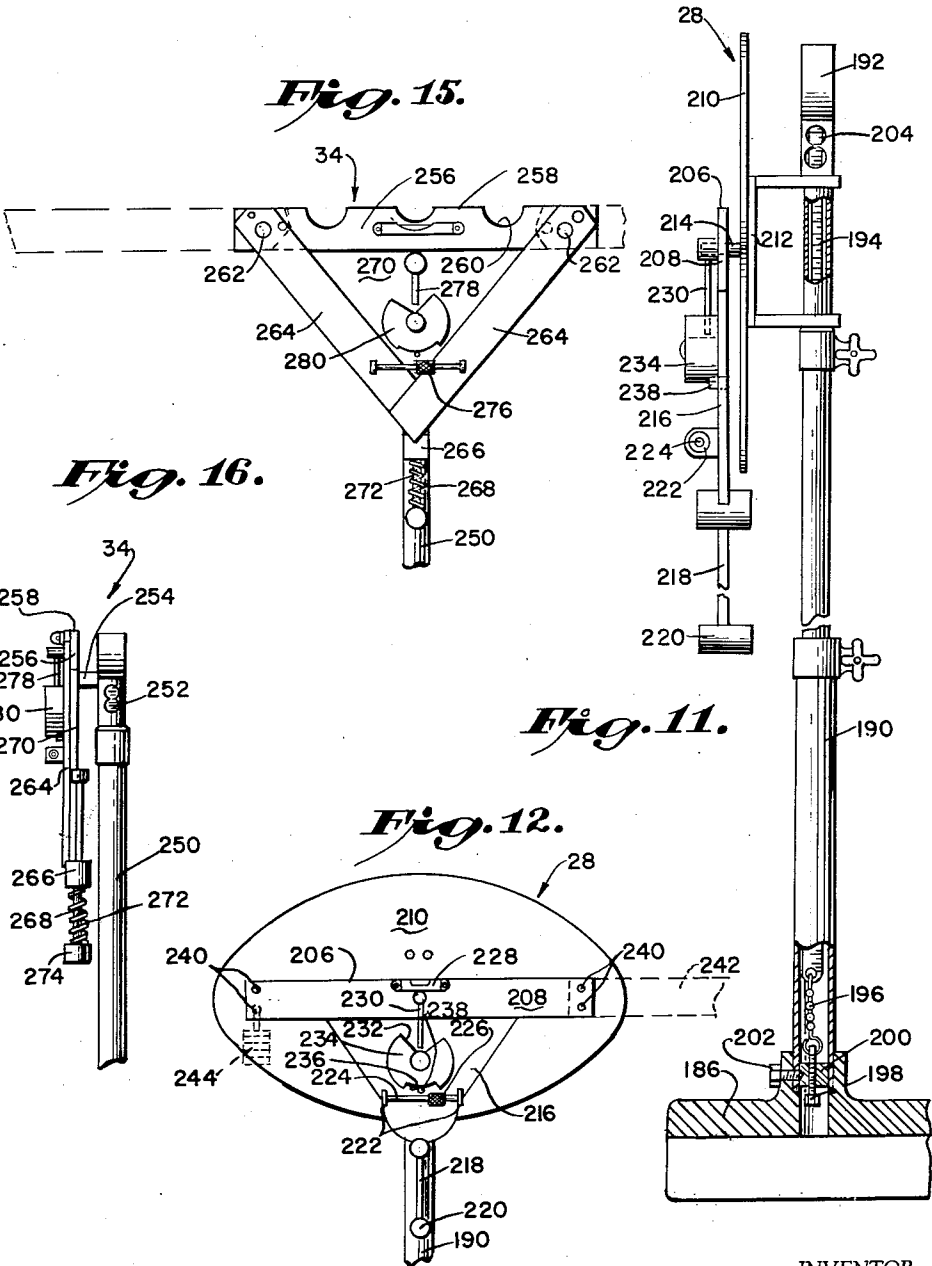
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Fig. 13.

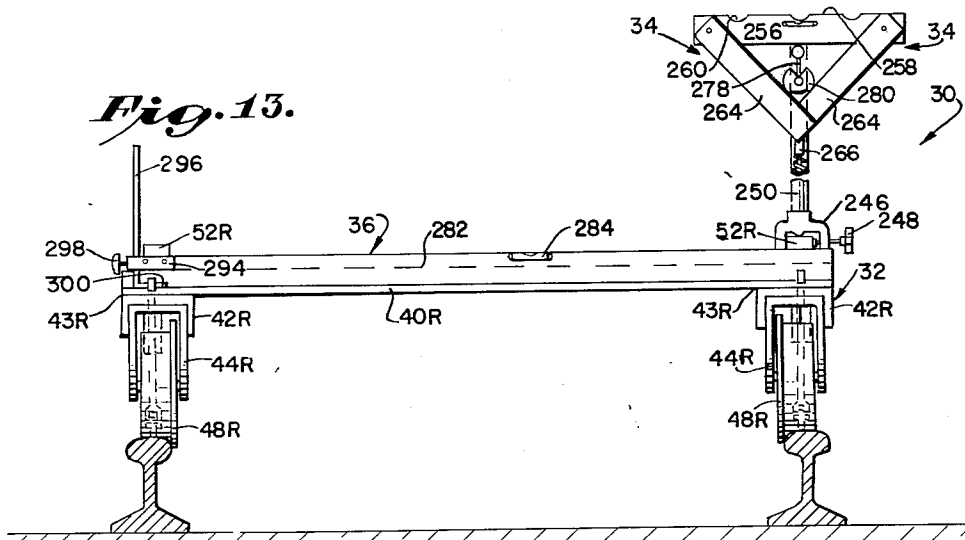


Fig. 14.

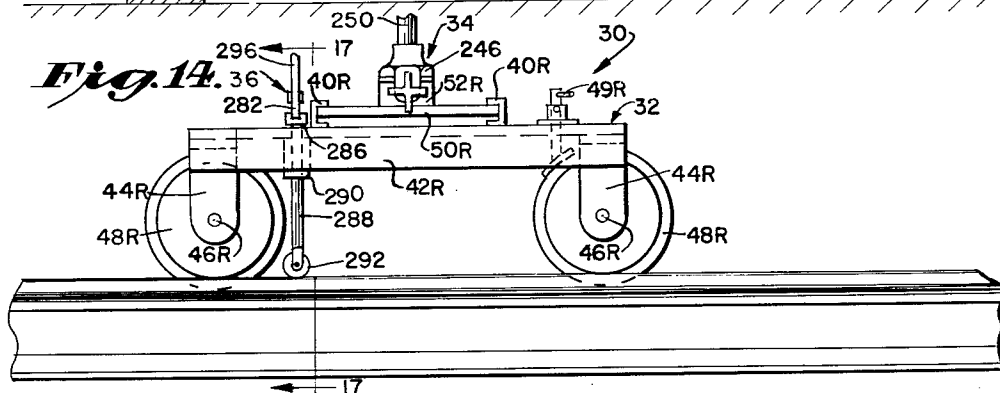
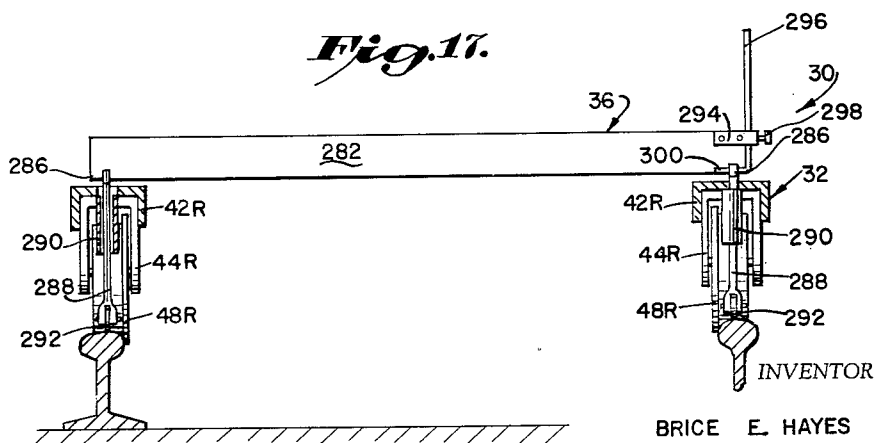


Fig. 17.



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SYSTEM OF ALIGNING RAILROAD TRACK
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Filed Dec. 31, 1958, Ser. No. 784,153
29 Claims. (Cl. 33—60)

This invention relates to optical equipment and more particularly to optical equipment utilized in aligning railroad track and the like.

The three point sighting method of surfacing railroad track is well-known in the art and has long been used by maintenance of way forces. In this method the foreman places a spot board on one side of a dip in the track, rests a second board in the depression and then sights over a third sighting block or peep sight which is the same height as the spot board. Looking through this peep sight the foreman sights on the spot board and instructs his road gang to raise the track until the intermediate or second board, sometimes called a "jack rabbit," reaches the level of his line of sight. The track is then straight along these three points and the gang proceeds down the track to the next depression which needs surfacing.

In recent years, this method has been employed not only in the spot raising of isolated sections of track having depressions thereon but in effecting a specific raising of an entire section of track. The operation is known in the art as "skin surfacing" and usually implies a raise of from one to three inches over an entire railroad during which the depressions are straightened. In this skin surfacing procedure the spot board indicates the vertical distance which the track is to be raised, the peep sight operating on track which has already been raised.

It has been proposed to replace the peep sight conventionally utilized in track surfacing with a telescope so as to extend the distance the spot board can be placed on the track from the foreman who is sighting the raise. With the use of either a peep sight or a telescope in the three point surfacing method, the spot board could be placed on the track a considerable distance from the foreman stationed at the sighting point and the system required an attendant for the spot board to place the same at the desired position on the track. Since this position was determined by the foreman at the sighting point, it was necessary for him to signal to the attendant at the spot board a considerable distance away in order to obtain the most desirable high spot in the track to which to sight. The necessity of the visible signal between the foreman and the attendant at the spot board resulted in considerable trouble to the foreman in placing the spot board at the most desirable high spot.

An object of the present invention is the provision of a system of aligning track, particularly surfacing the same, which operates on the basic three point method and which eliminates the need for an attendant to position the spot board on the track. It will be understood that labor has grown to constitute one of the biggest expenses in the maintenance of railroad track and equipment which eliminates manual labor readily, pays for itself over a relatively short period of operation.

Another object of the present invention is the provision of a track surfacing system of the type described embodying an improved target or spot board carriage which can be remotely controlled by an operator stationed some distance therefrom.

Still another object of the present invention is the provision of a target carriage of the type described having means operable in response to signals in the form of electromagnetic waves for controlling the movement thereof along a railroad track or the like.

Still another object of the present invention is the pro-

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vision of a target carriage of the type described having improved spot board means embodied therein.

Still another object of the present invention is the provision of a track surfacing system of the type described having an improved sighting carriage embodied therein.

A further object of the present invention is the provision of a sighting carriage of the type described having means mounted thereon for sending signals in the form of electromagnetic waves operable to control a remote target carriage.

A still further object of the present invention is the provision of a sighting carriage of the type described having improved telescope sighting means thereon.

Still another object of the present invention is the provision of a track surfacing system of the type described having an improved raising carriage embodied therein.

Still another object of the present invention is the provision of a raising carriage of the type described having an improved jack rabbit means thereon.

Still another object of the present invention is the provision of a raising or leveling carriage of the type described having improved level board means embodied thereon.

A still further object of the present invention is the provision of a vertically adjustable sighting board and improved means for indicating the vertical height of a reference objective thereon.

Still another object of the present invention is the provision of a sighting board which is self-leveling and improved means for dampening the action of the same.

The system of the present invention is particularly applicable in surfacing tangent and curved track. In addition, the telescope embodied in the system is readily adaptable for use in lining railroad track, particularly tangent track.

Accordingly, it is a still further object of the present invention to provide a system of the type described embodying improved telescope sighting means operable not only in the surfacing of track but the lining of track as well. The term "aligning" as herein used comprehends within its meaning the surfacing of railroad track wherein the track is brought into vertical alignment with the proper upper contour of the road bed and the lining of track wherein the track is brought into horizontal alignment with the proper upper contour of the road bed.

These and other objects of the present invention will become more apparent during the course of the following detailed description and appended claims.

The invention may best be understood with reference to the accompanying drawings, wherein an illustrative embodiment is shown.

In the drawings:

FIGURE 1 is a diagrammatic, top plan view illustrating a system embodying the principles of the present invention;

FIGURE 2 is a diagrammatic side elevational view of the system;

FIGURE 3 is a top plan view of the sighting unit of the system;

FIGURE 4 is a front elevational view of the sighting unit with the seat removed;

FIGURE 5 is an enlarged, fragmentary cross-sectional view taken along the lines 5—5 of FIGURE 3 showing the parts in their surfacing position;

FIGURE 6 is a view similar to FIGURE 5 showing the parts in their lining position;

FIGURE 7 is a fragmentary, cross-sectional view taken along the line 7—7 of FIGURE 6;

FIGURE 8 is a schematic wiring diagram of the electric circuit of the system;

FIGURE 9 is a top plan view of the target unit of the system;

FIGURE 10 is a front elevational view of the target unit;

FIGURE 11 is an enlarged, fragmentary, side elevational view of the spot board assembly with parts broken away for purposes of illustration;

FIGURE 12 is a fragmentary, front elevational view of the sighting bar of the spot board assembly;

FIGURE 13 is a front elevational view of the raising unit of the system;

FIGURE 14 is a side, elevational view of the raising unit;

FIGURE 15 is an enlarged, fragmentary front elevational view of the jack rabbit board;

FIGURE 16 is a side elevational view of the jack rabbit board; and

FIGURE 17 is a cross-sectional view taken along the line 17-17 of FIGURE 14, illustrating the leveling board assembly.

Referring now more particularly to the drawings, there is shown in FIGURES 1 and 2 a system embodying the principles of the present invention. In general, the system includes a sighting unit, generally indicated at 10, including a wheeled carriage 12 having a telescope assembly 14 mounted thereon which, in a track surfacing operation, the foreman or other operator utilizes to obtain a reference line of sight.

Mounted on the target carriage 12 is a signalling device, generally indicated at 16, which is operated by the foreman or operator through a control box 18. The signalling device is operable to transmit signals in the form of electromagnetic waves, preferably of radio wave frequency, in response to the operation of the control box 18 to control the movement of a target unit, generally indicated at 20.

The unit 20 includes a wheeled carriage 22 having a signal receiving device 24 mounted thereon. The signal receiving device is operable to actuate a power transmitting assembly, generally indicated at 26, carried by the carriage 22 connected with the wheel means thereof for propelling the same.

When the system is utilized in surfacing track the foreman or operator stationed adjacent the telescope assembly 14 actuates the control box 18, to actuate the signalling device 16 to transmit signals to the signal receiving means 24 of the target unit 20 so that the power transmission assembly will, in turn, effect movement of the carriage 22 into a desired position along the track remote from the sighting unit 10. The target unit includes a spot board assembly, generally indicated at 28, which forms a target upon which the operator sights the telescope assembly 14.

The system also embodies a raising unit, generally indicated at 30, which includes a wheeled carriage 32 having a jack rabbit assembly 34 mounted thereon. The jack rabbit assembly provides the operator with a means whereby he can determine the height of the track between the sighting unit and the target unit and any track that is disposed below the line of sight can be raised by the crew until the jack rabbit assembly coincides with the line of sight. To assist in transversely leveling both rails during the raising operation, the raising unit 30 also has mounted thereon a leveling board assembly, generally indicated at 36.

Preferably, the carriages 12, 22 and 32 of the units 10, 20 and 30 respectively, are identical in construction although they may be varied, if desired. By making the carriages identical the parts are interchangeable and economies in production and maintenance are secured. Since the carriages are identical a description of one should suffice to give a clear understanding of the construction of all. In the subsequent description, the same reference numerals designate corresponding parts of all the carriages, the subscript letter S after the numeral in-

dicating the parts of the sighting carriage; the subscript T, the target carriage parts, and the subscript R the raising carriage parts.

Referring now more particularly to FIGURES 3-7, the carriage 12 of the sighting unit 10 comprises a pair of transversely extending, longitudinally spaced frame members 40 preferably of channel construction. Rigidly secured to each of the ends of the frame members 40, as by insulated bolts or the like, is a longitudinally extending side frame member 42 which also is in the form of an inverted channel. Preferably, a sheet of insulating material 43, such as mica or the like, separates the frame members, as shown in FIGURE 4. A yoke 44 of inverted U-shaped configuration is rigidly secured at each end of each side frame member 42. Journalled between the lower ends of the legs of each yoke 44, as by a shaft 46, is a flanged wheel 48. One wheel on each side of the carriage has associated therewith a manually actuated holding brake 49 of conventional construction.

The transversely extending channel frame members 40 are preferably arranged so that the channels open toward each other and a horizontal platform 50 is suitably mounted between the channels. Mounted adjacent each end of the platform 50 is an upstanding block 52.

The telescope assembly 14 is preferably constructed in accordance with the disclosure of my co-pending application Serial No. 659,366, filed May 15, 1957. While a detailed description of the assembly 14 is not believed to be necessary for the reason that reference can be had to the above-mentioned co-pending application, in brief, the assembly 14 comprises a base 54 of generally inverted U-shaped configuration arranged to seat on one of the blocks 52S. As best shown in FIGURE 5, the base 54 is suitably secured to the block by a manually-operable screw clamp 56. Mounted on the base 54 for pivotal movement about a longitudinal, horizontal axis is the lower end of a telescoping staff 58. The staff is aligned vertically about its pivotal axis on the base 54 by any suitable means, such as an adjusting device 60. Mounted on the upper end of the telescopic staff 58 for movement about a vertical axis and for movement about a transverse horizontal axis is a telescope unit 62 which includes a pair of telescopes 64 mounted in parallel relation with respect to each other and facing in opposite directions. It will be understood that each of the telescopes may, if desired, include the usual horizontal and vertical cross hairs.

In surfacing of track, the upper telescope 64 is utilized. In order to determine the distance between the upper telescope and the tread of the track upon which the sighting carriage is mounted a measuring device, generally indicated at 66, is operatively connected between the head 62 and the base 54 of the telescope assembly. The device 74 preferably includes a housing 68 fixed to the upper end of the staff 58 for receiving a measuring tape 70 in coil formation. The tape 70 is mounted within the housing so that one end thereof will pay out from the coil formation, which end is secured to the lower end of the staff, as by hook 71. The coil formation of the tape is mounted within the housing by conventional resilient means (not shown) which serves to wind in the tape as the telescope is lowered. A window 72 is provided in the housing 68 and has a suitable marking thereon whereby the indicia on the tape designating the height of the center of the upper telescope 64 can be read.

As shown in FIGURE 5, when the telescope assembly 14 is used in surfacing track the vertical cross hair will be disposed in a vertical plane passing outwardly of the gage side of the rail. Of course, where the telescope assembly is utilized in lining track, the vertical cross hair of both telescopes must be disposed in a vertical plane intersecting the gage side of the rail, as shown in FIGURE 6. To effect movement of the telescope assembly 14 between these two positions, the right hand

block 52S has a pair of longitudinally spaced bores 74 extending horizontally therethrough for receiving a pair of rods 76. The rods are fixedly secured between a pair of transversely spaced brackets 78 secured to the platform 50S. Mounted on each rod 76 in surrounding relation thereto between the inner bracket 78 and the block 52S is a coil spring 80 which resiliently urges the block transversely outwardly. The outward movement of the block is limited by engagement of the same with the outer bracket 78.

When it is desired to utilize the telescope assembly 14 for the purpose of lining track, the block 52S upon which the same is mounted is moved inwardly against the action of the springs 80 and a bar 82 having one end pivoted, as at 84, to the lower end of an arm 86 fixed to the underside of the block 52S, is moved into a vertical position so that upon release of the block, the bar will engage the gage side of the rail as shown in FIGURE 6. To effect movement of the telescope assembly from the position shown in FIGURE 6 to the position shown in FIGURE 5, the block 52S is moved against the action of the springs 80 and the bar 82 pivoted upwardly into a horizontal position as shown in dotted lines in FIGURE 7. The block is then allowed to move through the action of the spring 80 into its outermost position and a pin 90 formed on the channel frame member 42S receives the outer end of the bar and retains the same in its horizontal position.

The telescoping staff 58 of the telescope assembly permits the foreman or operator to position the telescope at any desired vertical position within the range provided. Thus, the telescope can be utilized with the operator in a standing position or in a sitting position. Where the latter is desired, the carriage 12 is provided with a seat 92 mounted on the upper end of a telescoping pipe 94, the lower end of which has a wheel 96 mounted thereon for engagement with the track. Rigidly secured to the lower end of the telescoping pipe 94 is one end of an arm 98, the other end of which is detachably connected with the associated end of the side frame member 42S, as indicated at 100 in FIGURE 3. Of course, this connection can be made with the opposite member 42S, if desired.

The signalling device 16 is of well-known construction and any commercial transmitter of the portable type operable to send out at least two, and preferably three, distinct signals may be employed. A device which may be utilized is the 5 channel transmitter model G.L.R. 25 produced by Ga-Lin. R.C. Products of Chicago, Illinois. This transmitter is complete with batteries and collapsible antenna and operates on the Citizen Band under Class C. It embodies a 5 multiple channel system, the details of which are not necessary to an understanding of the present invention. For present purposes, suffice it to say that the device is operable to transmit three separate signals on three separate frequency channels and the control box 18 includes three buttons, 102, 104 and 106, each of which when pressed serve to actuate the transmitting device 16 to transmit a corresponding signal.

As shown in FIGURE 4, the control box 18 is mounted in a saddle member 108 secured to the upper end of a telescoping staff 110, the lower end of which is secured to an inverted U-shaped base 112. A block 114 is mounted on the platform 50S adjacent each side thereof for alternatively receiving the U-shaped base 12. The base is secured to the block by a manually actuated screw clamp 116.

The signal receiving device 24 of the target unit 20 is also of conventional construction. One example of a receiving device that can be utilized is the 5 channel receiver model 35 manufactured by Ga-Lin. R.C. Products. This device is operable to complete a separate electrical circuit in response to any one of the three signals transmitted by the transmitting device.

The power transmitting assembly 26 includes a reversible electric motor 118 having its output shaft connected

as by a belt and pulley assembly 120 with the input shaft of a speed reducing unit 122. As shown in FIGURES 9 and 10, the speed reducing unit includes a worm gear and pinion transmission 124 of the self-locking type which provides a brake to prevent movement of the target carriage when disposed on inclined track. The output shaft of the speed reducing unit 122 is connected with a transversely extending horizontal shaft 126, as by a belt and pulley assembly 128 having a tensioning idler 130 which can be manually controlled. The shaft 126 is mounted beneath the platform 50T by a suitable bearing 132 which is resiliently biased downwardly, as by a spring 134. The outer end of the shaft has a drive wheel 136 mounted thereon, having a tread or tire of frictional material, such as rubber, plastic, or the like, arranged to frictionally engage the ball of the rail to drive the target unit 20.

Referring now more particularly to the wiring diagram shown in FIGURE 8, it will be seen that a battery 138 is provided for energizing the signal receiving device 24 through leads 140 and 142, the latter having a manual switch 144 therein through which energization of the device can be controlled. Suitably connected with the output of the signal receiving device 24 to be selectively energized thereby are the coils of three relays 146, 148 and 150. The switches of the relays are embodied in an electric circuit controlling the operation of the electric motor 118.

The motor 118 can be any D.C. motor which reverses direction upon feeding current from a storage battery 151 in opposite directions thereto. To effect this reversal, the relays 146 and 148 include double pole switches 152 and 154 respectively, one pair of contacts of the switch 152 being connected between one terminal of the battery 151 and one terminal of the motor, through leads 156 and 158. The other pair of contacts of the switch 152 is connected across leads 160 and 162, extending from the other terminal of the battery to ground. It will be seen that when the switch contacts 152 of the relay 146 are closed negative terminal of the battery is grounded while the positive terminal is connected to one side of the motor, the other being grounded, as indicated at 164.

The polarity of the motor ground 164 is changed from negative to positive by leads 166 and 168 extending from the positive lead 156 to ground and connected across one pair of switch contacts 154 of the relay 148. Negative potential is brought to the motor 118 through leads 170 and 172 connected across the other pair of switch contacts 154 between negative lead 160 and the motor.

The entire circuit is under the control of a manual switch 174 in series in the lead 156 and a light 176 connected in parallel across the leads 156 and 160 to indicate when switch 174 is closed and the circuit is in operation.

The switch of the relay 150 controls the operation of an electrically actuated horn 178, connected between positive battery lead 156 and the ground in the circuit across the relay 150 switch by leads 180, 182 and 184.

The spot board assembly 28 of the target unit 20 comprises an inverted U-shaped base 186 arranged to be selectively mounted on either one of the blocks 52T. As before, a knobbed screw clamp 188 is provided for fixing the base on the block.

As best shown in FIGURE 11, rigidly secured to the base and extending upwardly thereof is a telescoping staff 190 of hollow tubular construction. The staff 190 like the staffs 58 and 110 are preferably constructed in accordance with the disclosure of my co-pending application Serial No. 659,366 noted above. Secured to the upper end of the staff is a housing 192 within which a measuring tape 194 is mounted in coil formation in a manner similar to the tape 70 previously described. One end of the tape is operable to pay out from the coil formation and is extended within the hollow telescopic staff members and is secured to the lower end of the lower member by means of a bead chain 196 having its lower end secured to a threaded element 198 extending within

a disc 200. The disc is secured within the lower member by any suitable means such as a bolt 202 extending through the base and tubular member and into the disc. A window 204 is formed in the housing 192 through which the indicia on the measuring tape can be read.

The indicia are calibrated to give an indication of the vertical position of a reference objective 206 in the form of an upper edge of a sighting bar 208 pivoted on a spot board 210 which may be of oval configuration, as shown in FIGURE 12. The spot board is fixedly mounted on the upper end of the staff 190, as by a U-shaped bracket 212 and has a horizontal shaft 214 extending outwardly therefrom in fixed relation thereto. The shaft 214 forms the pivotal axis of the horizontal bar.

Fixed to the lower edge of the bar 208 is a plate 216 having an arm 218 extending downwardly therefrom, upon which weight 220 is threadedly mounted. In addition, a pair of horizontally spaced brackets 222 are secured to the plate between the pivotal axis thereof and the pendulum weight. A threaded member 224 is mounted between the brackets and has threadedly mounted thereon a horizontally movable adjusting weight 226.

A spirit level 228 is mounted on the sighting bar 208 to determine that the upper horizontal edge 206 thereof is in proper level condition. It will be understood that the weight 226 can be adjusted to effect proper horizontal level of the edge 206.

In order to prevent undue pendulum action of the sighting bar 208, a dampening means is provided which comprises an arm 230 extending downwardly from the shaft 214 and fixed thereto. The lower end of the arm is disposed between a wedge-shaped cut out portion 232 formed in a disc 234 of hard rubber or the like. The disc is pivotally mounted on the plate 216 for movement about its axis between the shaft 214 and weight 220 and the lower periphery thereof is notched as indicated at 236. A pin 238 is mounted on the plate 216 in a position to engage the portions of the disc defining the ends of the notch.

It will be seen that a pendulum movement of the sighting bar 208 and plate 216 will result in the movement of the disc 234 into engagement of the lower end of the fixed arm 230 so that the disc will be pivoted by the arm, thus bringing the opposite surface of the V-shaped notch into close engagement with the other side of the arm. As the bar and plate swing back in the opposite direction, the arm will engage the opposite surface of the notch and this procedure is repeated until the swinging motion of the spot board is completely dampened out.

In surfacing curved track, it may be desirable to lengthen the horizontal extent of the sighting bar. To this end, each end of the bar 208 is provided with a pair of vertically spaced apertures 240 and additional bars 242 similar to the bar 208 may be selectively secured to either end of the latter by bolts extending through the apertures. Where a bar 242 is secured to one side of the bar 208, as shown in broken lines in FIGURE 12, the opposite side of the bar is preferably provided with weights 244, suspended from the associated lower aperture 240.

The jack rabbit assembly 34 of the raising unit 30 comprises an inverted V-shaped base 246 having a screw clamp 248 therein through which the same may be selectively secured to the blocks 52R, on the raising carriage 32. A hollow telescopic staff 250, similar to staffs 58, 110 and 190, extends upwardly from the base and has a measuring tape 252 embodied therein in a manner similar to the measuring tape 194.

Pivoted to a horizontal shaft 254 fixed to the upper end of the staff 250 is a jack rabbit sighting bar 256 having a reference objective 258 in the form of an upper horizontal edge. The sighting bar has a plurality of spaced notches 260 formed in the edge 254 thereof so

that in the event that the latter is disposed in a vertical position above the track greater than the vertical position of the sighting bar of the spot board assembly, the edge 206 of the latter will be visible to the operator through the notches.

Mounted on each end of the bar 256, as by horizontal pivots 262, is a bar or arm 264 which can be moved from the position shown in FIGURE 15 in full lines when surfacing tangent track, to a horizontal alignment position shown in broken lines in FIGURE 15 for surfacing curved track. In order to maintain the bars 264 in their collapsed, full line position, a notch block 266 is slidably mounted on a vertical arm 268 fixed in depending relation to a plate 270 rigid with the lower edge of the sighting bar 256. A spring 272 is mounted in surrounding relation on the arm between a weight 274 secured to the lower end thereof and the block 266 for resiliently urging the latter upwardly. It will be seen that the notched block receives the outer corners of the bars and the spring serves to maintain them therein. When it is desired to use the bars in their horizontal position, the block is moved downwardly against the action of the spring and one or both of the bars are pivoted outwardly. Any suitable means may be provided for maintaining the bars in their horizontal position as, for example, bolts or the like (not shown).

Secured to the plate 270 is a horizontally adjustable weight 276 similar to the weight 226 previously described in connection with the spot board assembly 28. In addition the jack rabbit bar is provided with a dampening means, similar to the dampening means previously described, which generally includes an arm 278 fixed to the shaft 254 and a notched disc 280 pivoted to the plate 270.

The leveling board assembly 36 of the unit 30 comprises a transverse horizontal board 282 having a spirit level 284 mounted in the central portion thereof for indicating when the upper surface of the board is disposed in a true horizontal plane, as shown in FIGURES 13 and 17. The ends of the board are supported in saddles 286 secured to the upper end of a rod 288 which extends through a suitable aperture formed in the associated side frame member 42R and an oversize pipe section 290 secured beneath the channel member. The lower end of each rod 288 has journaled thereon a roller 292 for engaging the ball of the associated rail.

On one end of the leveling board 282 there is provided a U-shaped strap 294, the legs of which are secured to the board in a position to dispose the bight portion in spaced relation from the end thereof. Mounted for vertical movement between the end of the board and the bight portion of the strap is a calibrated bar 296. A screw clamp 298 is threaded within the bight portion of the strap for engaging the bar to secure the same in any desired position of vertical adjustment with respect to the board. The lower end of the bar has an inwardly turned flange 300 for engaging the saddle.

Operation

While the system of the present invention is useful in surfacing track in general, as, for example, in raising isolated depressions and the like, the operation will be described in connection with the raising of an entire line which is a practice being adopted more and more as standard maintenance procedure. In such a procedure, the crew using conventional track jacks, tampers and like maintenance equipment proceeds along a track raising the same one, two or three inches. From the track which has been raised, the new track is sighted, usually by the trained eye of the foreman, until a distant high spot is found. The section of the track between that already raised and the distant high spot is then raised. In raising the section, a line of sight is obtained from a point at a predetermined height over the track already raised to a point at a height over the

high spot a distance equal to the aforesaid predetermined height plus the amount of raise to be given to the track. Thus, by bringing the track section up to this line of sight not only is the section raised but depressions therein are straightened out as well.

In using the present system for making a one-inch raise in a track line, the sighting carriage 12 is positioned over the portion of track already raised, as shown in FIGURE 2. The operator then sets the upper telescope 64 of the telescope assembly 14 to a desired height by adjusting the telescopic staff 58 thereof. The working height of the telescope 64 may be chosen sufficiently low to enable the operator to sight through the same while seated on the seat 92 or the operator may choose to move it up to a standing position.

After the height of the telescope is adjusted, the operator takes a reading through window 72 of the tape 70, which may be, for example, forty-one inches. The height of the reference objective or edge 258 of the jack rabbit assembly 34 is then adjusted by the telescopic staff 250 until tape 252 gives a corresponding reading.

Finally, the height of the reference objective or edge 206 of the spot board assembly 28 is adjusted by the telescopic staff 190 until tape 194 gives a reading one inch greater or forty-two inches.

Assuming that the target carriage has been properly located, the operator then sights through the upper telescope 64 onto the spot board 210. Using this line of sight he then signals to the crew stationed adjacent the raising unit 30 to raise the track until the edge 258 thereof is in this line of sight or until it coincides with the edge 206. The track upon which the raising unit 30 is mounted is then at the desired grade. It will be noted that the leveling board assembly 36 provides the crew at the raising unit with a ready reference with which to check that both rails are properly transversely leveled. After the rails are properly leveled, the crew moves the raising carriage 32 to the next raising point and the procedure is repeated.

When it becomes necessary to move the target unit 20 forward to a new desired high spot, the operator stationed at the telescope first sounds a warning blast on the horn 178 mounted on the target carriage. To accomplish this, button 106 is pushed to activate signal transmitting device 16 to send a radio wave signal which is picked up by signal receiving device 24. The coil of relay 150 is energized in response to the actuation of device 24 and the switch of the relay completes a circuit to the horn 178.

Next, the operator pushes button 102 which activates signal transmitting device 16 to transmit a signal in the form of an electromagnetic wave of different radio frequency. This signal is picked up by the signal receiving device 24 which, in turn, is activated to energize the coil of relay 146. Switch 152 is thus closed completing the circuit to motor 118 which, upon rotation, serves to rotate wheel 136 through speed reducing unit 122. By watching the relative vertical movement between reference objectives 206 and 258 through upper telescope 64, the operator can readily ascertain the high spots in the track some distance away with considerable accuracy.

It will be understood that the button 104 serves to move the target carriage in the opposite direction by reversing the rotation of motor 118 through the operation of relay 148. Thus, by selectively actuating the buttons 102 and 104 of the control box 18, the operator can bring the target carriage to the desirable high spot without the need of an assistant and the inconveniences incident thereto. With the target unit properly located and held in position by the pinion and worm gear transmission of the unit 122, the raising procedure noted above is repeated.

The blocks 52S on opposite sides of the sighting carriage 32 provide a means whereby the telescope assembly can

be moved for surfacing from the low rail on both right and left hand curves. When surfacing around curves, the arms or bars 264 of the jack rabbit assembly 34 are moved into their horizontal position shown in dotted lines in FIGURE 15. Of course, blocks 52R may be used alternatively for right and left hand curves. The entire carriage 32 can be reversed, if desired, and the leveling board 282 is readily reversible in saddles 286 so that calibrated bar 296 can be used over either rail. In a like manner any desired number of bars 242 and corresponding weights 244 can be used to horizontally extend the reference objective 206 of the target unit 20 when working on curves and opposed blocks 52T are provided for right and left hand curves.

When lining operations are desired, the arm 82 is lowered into engagement with a rail to dispose the vertical cross hair of the telescopes in the vertical plane of the gage side of the rail as shown in FIGURE 6. In this position, the telescope assembly can be used in lining track in the manner set forth in the aforesaid copending application.

The present system thus provides considerable versatility of operation. In surfacing, the operator is enabled to see the spot board better and obtain greater accuracy when sighting in than by the naked eye. Of primary significance however is the saving in labor, which over an extended period of time results in important economies. All of the carriages are of relatively light weight and can be easily removed from the track when desired. Moreover, the signal transmitting device 16, control box 18 and staff, telescope assembly 14, spot board assembly 28, jack rabbit assembly 34 and leveling board 282 are readily removable for safe keeping after operations for the day have been completed. The battery 151, signal receiving device 24, motor 118 and transmission unit 122 are disposed in appropriate housings to prevent access.

It thus will be seen that the objects of this invention have been fully and effectively accomplished. It will be realized, however, that the foregoing specific embodiment has been shown and described only for the purpose of illustrating the principles of this invention and is subject to extensive change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

I claim:

1. A system of aligning railroad track comprising telescope means arranged to be carried by the track to be aligned at a sighting position in predetermined relation therewith for sighting a line, means at said sighting position for transmitting signals in the form of electromagnetic waves, a driven wheeled carriage arranged to ride on the track for movement into a target position remote from said sighting position, target means carried by said carriage upon which the line is sighted to determine the position thereof, and means operable in response to the signals transmitted by said transmitting means for driving said carriage in both directions to thereby effect movement of the same into said target position, said last mentioned means comprising a driven wheel on said carriage, a motor operatively connected with said wheel for driving the same, and signal receiver means on said carriage operable in response to a predetermined signal from said transmitting means for actuating said motor to drive said wheel, said motor being operatively connected to said wheel by means including a worm gear speed reducer operable to prevent turning of said wheel when said motor is rendered inoperative.

2. A system of aligning railroad track comprising telescope means arranged to be carried by the track to be aligned at a sighting position in predetermined relation therewith for sighting a line, means at said sighting position for transmitting signals in the form of electromagnetic waves, a driven wheeled carriage arranged to ride on the track for movement into a target position remote from

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said sighting position, target means carried by said carriage upon which the line is sighted to determine the position thereof, and means operable in response to the signals transmitted by said transmitting means for driving said carriage in both directions to thereby effect movement of the same into said target position, said last mentioned means comprising a driven wheel on said carriage, a motor operatively connected with said wheel for driving the same, and signal receiver means on said carriage operable in response to a predetermined signal from said transmitting means for actuating said motor to drive said wheel, said motor being a reversible electric motor, said signal receiver means being operable to selectively actuate said reversible motor in either direction in response to one of two distinct signals from said transmitting means.

3. A system as defined in claim 2 wherein a horn is mounted on said carriage and said signal receiving means is operable to actuate said horn in response to a third predetermined signal from said transmitting means.

4. A system of aligning railroad track comprising telescope means arranged to be carried by the track to be aligned at a sighting position in predetermined relation therewith for sighting a line, means at said sighting position for transmitting signals in the form of electromagnetic waves, a driven wheeled carriage arranged to ride on the track for movement into a target position remote from said sighting position, target means carried by said carriage upon which the line is sighted to determine the position thereof, and means operable in response to the signals transmitted by said transmitting means for driving said carriage in both directions to thereby effect movement of the same into said target position, said target means comprising a telescopic staff mounted on said carriage, a spot board sighting member pivotally mounted on the upper end of said staff in pendulum fashion, a horizontal reference objective on said member, and means for dampening the pendulum action of said member, said dampening means comprising an arm fixed with respect to said staff, an element pivoted to said sighting member about an axis spaced from the pivotal axis thereof, said element having a cut-out portion therein receiving said arm.

5. A system of aligning railroad track comprising telescope means arranged to be carried by the track to be aligned at a sighting position in predetermined relation therewith for sighting a line, means at said sighting position for transmitting signals in the form of electromagnetic waves, a driven wheeled carriage arranged to ride on the track for movement into a target position remote from said sighting position, target means carried by said carriage upon which the line is sighted to determine the position thereof, and means operable in response to the signals transmitted by said transmitting means for driving said carriage in both directions to thereby effect movement of the same into said target position, said target means comprising a base mounted on said carriage, a lower elongated hollow member secured to said base and extending upwardly therefrom, an upper elongated hollow member mounted for vertical telescopic movement with respect to said lower member and said base, a spot board mounted on said upper member, said spot board having a reference objective thereon and means for indicating a vertical distance between the reference objective of said spot board and the track, said indicating means comprising a measuring tape having indicia thereon, said tape being disposed in coil formation and operable to pay out at one end from said coil formation and resiliently return thereto by relative movement between said one end and said coil formation, means mounting the coil formation and the one end of said tape between said upper member and said base for relative vertical movement therebetween in response to vertical movement of said upper member relative to said lower member and said base, said tape being mounted with substantially all of the payed out portion thereof disposed within said hollow upper and lower

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member in any position of vertical movement thereof, and fixed means adjacent the coil formation of said tape for designating the indicia thereon corresponding to the vertical distance between the reference objective and the track.

6. A system of aligning railroad track comprising telescope means arranged to be carried by the track to be aligned at a sighting position in predetermined relation therewith for sighting a line, means at said sighting position for transmitting signals in the form of electromagnetic waves, a driven wheeled carriage arranged to ride on the track for movement into a target position remote from said sighting position, target means carried by said carriage upon which the line is sighted to determine the position thereof, means operable in response to the signal transmitted by said transmitting means for driving said carriage in both directions to thereby effect movement of the same into said target position, and jack-rabbit means arranged to be carried by the track to be aligned at a position intermediate said telescope means and said carriage for determining the position of the portion of track carrying the same with respect to said line of sight.

7. A system as defined in claim 6 wherein said jack-rabbit board means comprises a telescopic staff having a jack-rabbit sighting member pivotally mounted in pendulum fashion on the upper end thereof, said sighting member having a horizontal reference objective thereon for alignment with said line of sight, and means for dampening the pendulum action of said sighting member.

8. A system as defined in claim 7 wherein said dampening means comprises an arm fixed with respect to said staff, and an element pivoted to said sighting member about an axis spaced from the pivotal axis thereof, said element having a cut-out portion therein receiving said arm.

9. A system as defined in claim 6 wherein said jack-rabbit means comprises a horizontal sighting bar providing an upper edge defining a horizontal reference objective, said bar having notch means formed in said edge thereof.

10. A system as defined in claim 9 wherein a pair of bars are mounted on opposite ends of said first mentioned bar for movement into and out of a position of horizontal alignment therewith.

11. A system of aligning railroad track comprising a sighting carriage mountable on a railroad track to ride thereon, telescope means carried by said sighting carriage, means on said sighting carriage for transmitting signals in the form of electromagnetic waves, a target carriage mountable on the railroad track for power driven movement thereon in both directions, target means on said carriage for determining a proper line of sight from said telescope means, means operable in response to the signals transmitted by said transmitting means for effecting the power driven movement of said target carriage, a raising carriage mountable on the railroad track to ride thereon in a position between said sighting carriage and said target carriage, and jack-rabbit means on said raising carriage for determining the position with respect to said line of sight of the portion of the track upon which said raising carriage is mounted.

12. A system as defined in claim 11 wherein said raising carriage has a transversely extending leveling board mounted thereon for angular and translational movement in a substantially vertical plane with respect thereto and for longitudinal movement with said raising carriage, and means connected with the ends of said leveling board for engaging the tracks and supporting said board in said vertical plane.

13. A system as defined in claim 12 wherein said last mentioned means at one end of said board comprises a vertically adjustable member for supporting the board in a level condition from track disposed in a transversely inclined plane.

14. A system as defined in claim 11 wherein said telescope means comprises a telescopic staff mounted on said

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sighting carriage having a telescope mounted on the upper end thereof and means for indicating the vertical distance between the center of the telescope and the portion of the track upon which said sighting carriage is mounted; wherein said target means comprises a telescopic staff mounted in said target carriage and having a sighting board member mounted on the upper end thereof provided with a horizontal reference objective and means for indicating the vertical distance between the reference objective and the portion of the track upon which said target carriage is mounted; and wherein said jack-rabbit means comprises a telescopic staff mounted on said raising carriage and having a jack-rabbit sighting member on the upper end thereof provided with a horizontal reference objective, and means for indicating the vertical distance between said jack-rabbit reference objective and the portion of the track upon which said raising carriage is mounted.

15. A system as defined in claim 14 wherein said sighting carriage includes a seat adjacent said telescope means.

16. In apparatus of the type described, the combination comprising a wheeled carriage for engagement with a railroad track to ride thereon, a vertical staff mounted on said carriage for transverse movement with respect thereto, a track engaging member connected with said staff for movement between a track engaging position wherein the same is transversely fixed with respect to said staff and a position disposed out of engagement with the track, and a telescope mounted on said staff for pivotal movement about a transverse horizontal axis.

17. The combination as defined in claim 16 wherein said staff comprises a plurality of telescopic vertical members and wherein means is provided for indicating the vertical distance between said telescope and the track engaged by said carriage.

18. In apparatus of the type described, the combination comprising a wheeled carriage for engagement with a railroad track to ride thereon; a member mounted on said carriage for transverse movement with respect thereto, spring means resiliently urging said member into a transversely outward limiting position, a telescope mounted on said member for pivotal movement about a transverse horizontal axis, said telescope including a vertical cross hair disposed over the ball of a track when said member is in said outward limiting position, and a track engaging element fixed transversely with respect to said member and movable vertically with respect thereto into a position to engage the gage side of the track to thereby limit the transverse movement of said member to an inner position wherein the vertical cross hair of said telescope is disposed in a vertical plane passing through the gage side of the track.

19. In a system of the type described, a target carriage comprising a frame having wheel means thereon for engaging a railroad track, said wheel means including a driven wheel, a reversible electric motor carried by said frame, power transmission means between said motor and said driven wheel, an electrical circuit for actuating the motor to thereby drive the driven wheel through said transmission means, said circuit including means operable in response to a radio signal of a first predetermined frequency for effecting actuation of said motor in one direction and means operable in response to a second radio signal of a second predetermined frequency for effecting actuation of said motor in the opposite direction, and target means on said frame providing a reference objective upon which a line of sight is directed.

20. A target carriage as defined in claim 19 wherein said power transmission means includes a worm gear speed reducer.

21. In apparatus of the type described, the combination comprising a frame having wheel means thereon for engaging a railroad track, a vertically adjustable staff mounted on said frame, a jack-rabbit sighting member on the upper end of said staff, said sighting member having an upper edge defining a horizontal reference objective,

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said member having notch means formed in said edge, and means for indicating the vertical distance between said reference objective and the track engaged by the wheel means of said frame.

22. The combination as defined in claim 21 wherein said sighting member is mounted on said staff for pivotal movement in pendulum fashion and means is provided for dampening the pendulum action of said member.

23. The combination as defined in claim 21 wherein a pair of bars is mounted on opposite ends of said sighting member for movement into and out of a position of horizontal alignment therewith.

24. In apparatus of the type described the combination comprising a base arranged to be carried by the track to be aligned in predetermined relation therewith, a lower elongated hollow member secured to said base and extending upwardly therefrom, an upper elongated hollow member mounted for vertical telescopic movement with respect to said lower member and said base, a sighting member mounted on the upper member, said sighting member having a reference objective thereon and means for indicating a vertical distance between the reference objective of said sighting member and the track, said indicating means comprising a measuring tape having indicia thereon, said tape being disposed in coil formation and operable to pay out at one end from said coil formation and resiliently return thereto by relative movement between said one end and said coil formation, means mounting the coil formation and the one end of said tape between said upper member and said base for relative vertical movement therebetween in response to vertical movement of said upper member relative to said lower member and said base, said tape being mounted with substantially all of the payed out portion thereof disposed within said hollow upper and lower members in any position of vertical movement thereof, and fixed means adjacent the coil formation of said tape for designating the indicia thereon corresponding to the vertical distance between the reference objective and the track.

25. The combination as defined in claim 24 wherein said sighting member is pivotally mounted on said upper member in pendulum fashion and wherein means is provided for dampening the pendulum action of said sighting member.

26. The combination as defined in claim 25 wherein said dampening means comprises an arm rigid with said upper member and a disk pivoted about its axis to said sighting member in spaced relation to the pivotal axis of the latter, said disk having a wedge-shaped notch formed therein receiving said arm.

27. In an apparatus of the type described, the combination comprising a support, a sighting member mounted on said support for free pivotal movement about a fixed substantially horizontal axis, and dampening means between said support and said sighting member for stabilizing the pivotal movement of the latter, said dampening means comprising an arm fixed to said support and a disk pivoted to said sighting member about its axis in spaced relation to the pivotal axis of the latter, said disk having a wedge-shaped notch therein receiving said arm.

28. The combination as defined in claim 27 wherein said disk is also provided with an arcuate peripheral notch and wherein a pin is carried by said sighting member within said notch for limiting the pivotal movement of said disk.

29. In apparatus for use in a three point system of aligning railroad track including first, second and intermediate means arranged to be supported on the track respectively at a first position on an aligned portion thereof, at a second position on an unaligned portion thereof remote from said first position and at an intermediate position on an unaligned portion thereof between said first and second positions which is to be aligned for determining when the portion of the track to be aligned in said intermediate position is in alignment

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with a straight reference established with respect to said first and second positions; the improvement comprising a wheeled carriage supporting said second means mountable on the track for movement thereon into said second position, means carried by said carriage and engageable with the track for effecting movement of said carriage along the track in both directions in response to electromagnetic signals of predetermined frequencies, and means remote from said carriage for transmitting electromagnetic signals of said predetermined frequencies to operate said carriage moving means so that said carriage can be moved thereby into said second position under the control of an operator adjacent said signal transmitting means remote from said carriage.

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