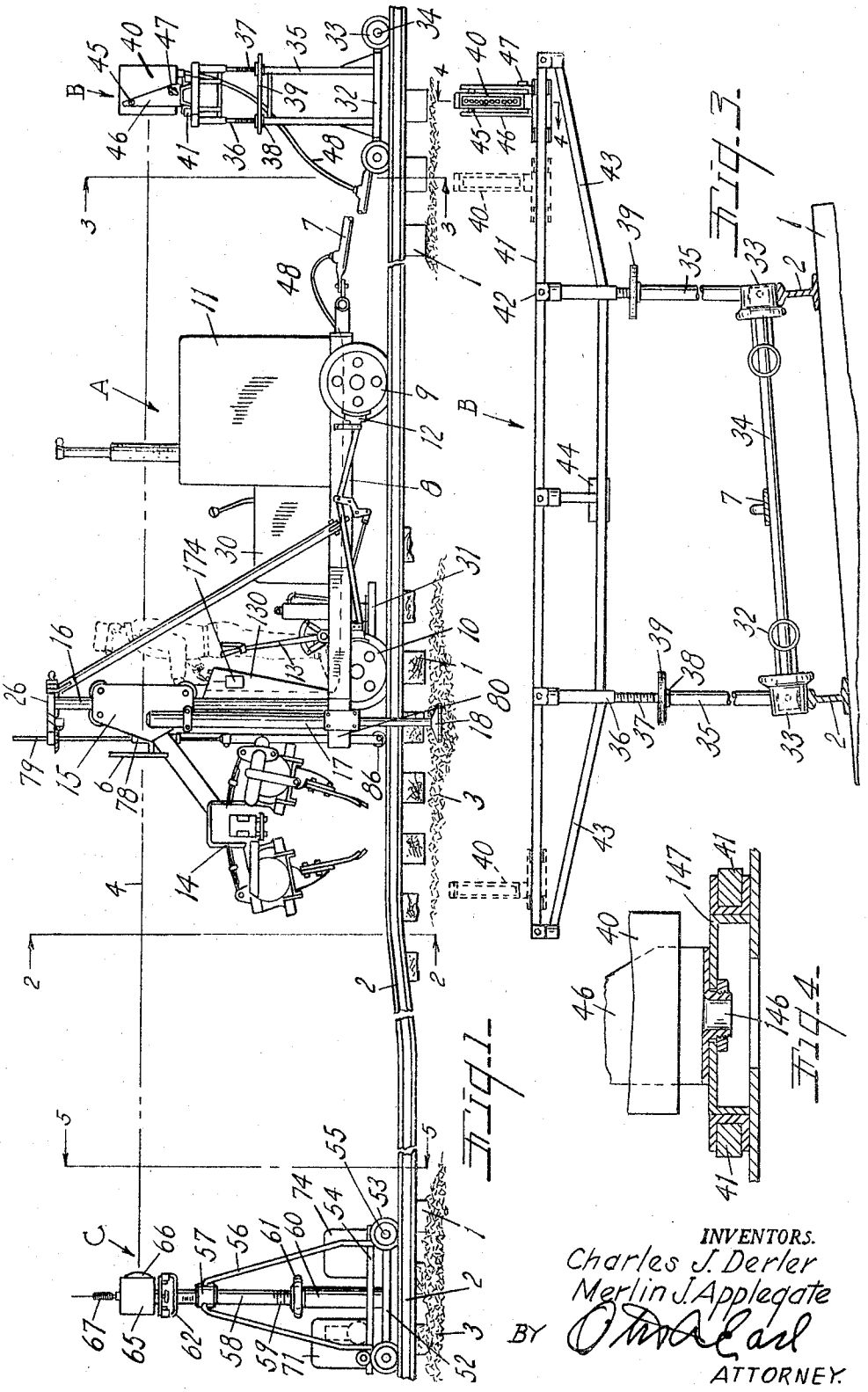
Sept. 6, 1966 C. J. DERLER ETAL 3,270,690

RAILWAY TRACK GRADING APPARATUS

Filed June 4, 1962 3 Sheets-Sheet 1



INVENTORS.
Charles J. Derler
Merlin J. Applegate
BY
ATTORNEY.

Sept. 6, 1966 C. J. DERLER ETAL 3,270,690

RAILWAY TRACK GRADING APPARATUS

Filed June 4, 1962 3 Sheets-Sheet 2

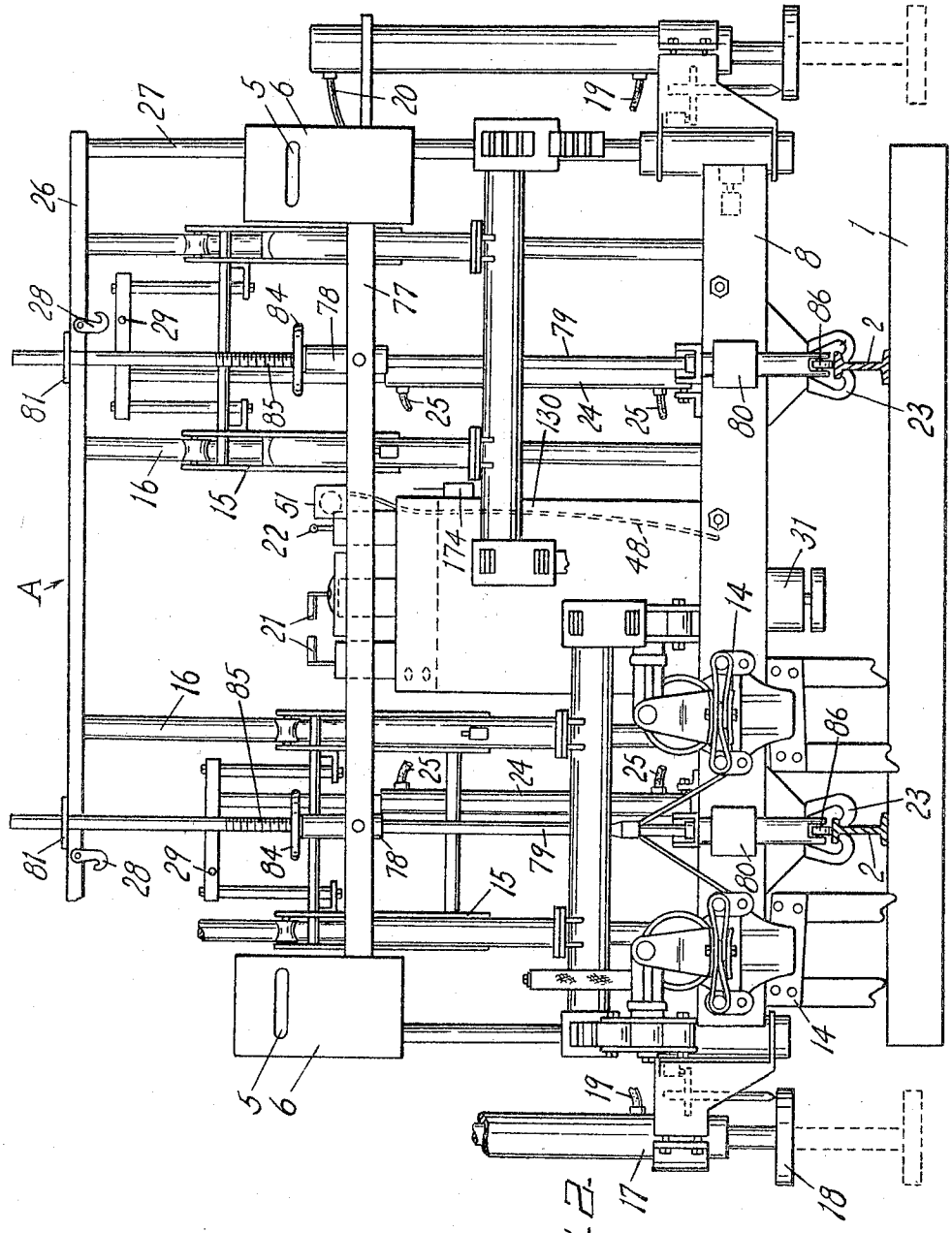


FIG. 2.

INVENTORS.
Charles J. Derler
Merlin J. Applegate
BY
ATTORNEY.

Sept. 6, 1966 C. J. DERLER ETAL 3,270,690

RAILWAY TRACK GRADING APPARATUS

Filed June 4, 1962 3 Sheets-Sheet 3

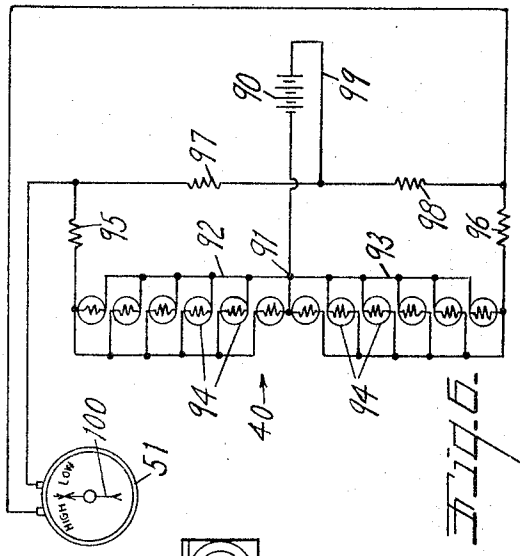


FIG. 6.

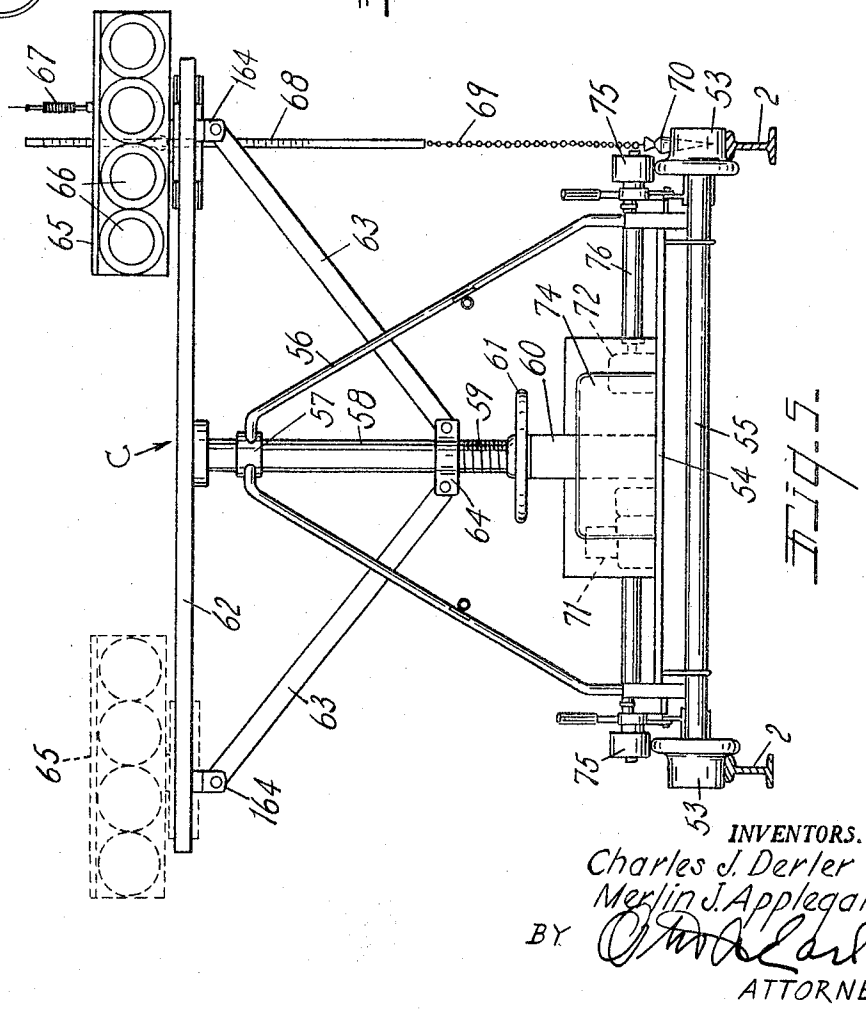


FIG. 5.

INVENTORS.
Charles J. Derler
Merlin J. Applegate
BY
ATTORNEY.

United States Patent Office 3,270,690 Patented Sept. 6, 1966

3,270,690

RAILWAY TRACK GRADING APPARATUS

Charles J. Derler, Ludington, and Merlin J. Applegate, Grand Rapids, Mich., assignors, by mesne assignments, to Jackson Vibrators, Inc., Ludington, Mich., a corporation of Illinois

Filed June 4, 1962, Ser. No. 199,720
5 Claims. (Cl. 104—7)

This invention relates to railway track grading apparatus.

The main objects of this invention are:

First, to provide a railway track grading apparatus utilizing a light beam as an index means which is easily operated and at the same time highly accurate and efficient.

Second, to provide a railway track grading apparatus comprising a powered first carriage including manually controlled means for gradingly adjusting the rails of the track on which it is supported; a second carriage connected to the first carriage to be propelled thereby and disposed rearwardly relative to the first carriage to be supported by and travel on track that has been graded by the first carriage, and a third carriage disposed on the track in front of and in substantially spaced relation to the first carriage and provided with an electronically and remotely controlled driving means.

Third, to provide a grading apparatus including the first, second and third carriages associated as stated, the third carriage having a light beam projecting unit thereon, the second carriage having a light beam receiving unit thereon and the first carriage having a light beam baffle unit which serves to baffle the beam projected by the third carriage which permits the passage of a ray of light to the second carriage when the track on which the first carriage is positioned has been adjusted to or is at the desired grade.

Fourth, to provide a track grading apparatus having these advantages which may be operated or controlled by a single operator stationed upon the first carriage.

Objects relating to details and economies of the invention will appear from the description to follow. The invention is defined and pointed out in the claims.

A preferred embodiment of the invention is illustrated in the accompanying drawing, in which:

FIG. 1 is a fragmentary somewhat conventionalized side elevational view of an apparatus embodying our invention disposed on a railway track which is also conventionally illustrated, the dash and dotted line representing a light beam.

FIG. 2 is a fragmentary view on a line corresponding to line 2—2 of FIG. 1 of the combined jack and tamper unit, various parts being shown conventionally.

FIG. 3 is a fragmentary front elevational view of the sensor carriage taken on a line corresponding to line 3—3 of FIG. 1, the track being shown with one of the rails substantially higher than the other as on a curve, this being illustrated to show certain of the adjustable features of this sensor carriage or unit, one of the light beam receiving units being shown in full lines in one adjusted position, and by dotted lines in other positions.

FIG. 4 is a fragmentary view on a line corresponding to line 4—4 of FIG. 3, showing the sliding support for lateral and angular adjustment of the light sensing unit.

FIG. 5 is a vertical transverse section on a line corresponding to line 5—5 of FIG. 1, illustrating structural features of the remotely controlled light beam carriage.

FIG. 6 is a wiring diagram of the indicator on the jack tamper unit and the sensor on the sensor carriage.

The embodiment of the applicants' invention illustrated comprises three carriages or units adapted to travel on a railway track, which are herein designated as first, second and third carriages, the first carriage being indicated in

FIG. 1 of the drawing by the letter A, the second carriage by the letter B, and the third carriage by the letter C. The first carriage A is a combined rail jack and tamper structure, details of certain of the parts not being illustrated and described except to point out their functional relationship, as tampers of this type in commercial use are manufactured and sold by Jackson Vibrators, Inc., assignee of this application. Various railway jack and tamper machines may be used with additions thereto adapting the same for use in connection with the second and third carriages B and C.

It is also desired to state that certain structural details or features which are included in the commercial embodiments of the second or light sensor carriage and of the third or light projector carriage are not illustrated or described, as such structural features are not the joint invention of the applicants.

In the accompanying drawing, 1 represents ties, 2 the rails, and 3 the ballast of a railway track. In FIG. 1 the portion of the track on which the carriage A is disposed is in the same plane or in alignment with the portion on which the carriage B is disposed, but it should be understood that in this view the portion of the track on which carriage A is mounted has been adjusted into alignment with the portion of the track on which the carriage B is positioned, and the carriage C is illustrated as being on a portion of the track which has not been graded. Otherwise stated, the first carriage has been adjusted to position to permit the light beam, designated by the dot and dash lines 4, to pass through the slot-like opening 5 in one of the baffles 6 to impinge the light sensor unit, hereinafter to be described, on the second carriage.

The second carriage B is connected to the first carriage A by means of the tubular draft rod 7 to be propelled by the first carriage in rearwardly spaced relation thereto and spaced to such degree that the second carriage is positioned on graded track while the first carriage is spaced forwardly therefrom on initially ungraded track, that is, assuming that the track requires regrading, and regrading of railway track is the primary object of the applicants' invention.

The carriage C is, as stated, controlled by a radio beam and may be, and in practice is, variably positioned on the track relative to the first carriage. This enables the positioning of the third or C carriage on the track as may be deemed most desirable in view of the conditions of the track that is being regraded. Usually a high point in the irregular ungraded track well ahead of the first carriage A is selected as a reference point and location for the light carriage C. Repositioning of the third carriage or light beam carriage is not required for each adjustment of the grading tamper carriage A.

The grading tamper carriage A comprises a body or frame 8 provided with front and rear pairs of wheels 9 and 10, one pair of these wheels being driven from a suitable power source disposed within the housing 11. Brake means 12 are provided for the wheels as it is desirable that the carriage be accurately positioned relative to the ties that are to be tamped. The brake means may be actuated by the lever 13 or by power operated means (not shown) under the control of the operator. The tamper unit, designated generally by the numeral 14, is that of the Jackson Patent No. 2,795,198, issued June 11, 1957, and therefore is not described in detail. It is desirably of the high frequency vibration type.

The two tamper units 14 are mounted for independent vertical adjustment, the supporting members 15 being mounted on upright slideways 16. The jacks of the embodiment illustrated are of the hydraulic type and comprise the cylinders 17 the ballast engaging members or shoes 18 being provided with plungers disposed within the cylinders 17. These cylinders are connected to a

source of fluid under pressure by the conduits **19** and **20**. These jack units are independently controlled, manual valve control means thereof being indicated at **21**. The tamper control is indicated at **22**, see FIG. 2.

Also operated in timed relation to the jack control means are the rail clamping jaw units designated generally by the numeral **23**, see FIG. 2, and these are controlled from the jack cylinders **17** in a manner disclosed in the application of Derler, Serial No. 1,466, filed January 11, 1960. Hydraulic cylinders **24** which have connections **25** to the source of hydraulic power are connected to the tamper support member **15** to selectively raise and lower the tampers. The jacks **17–18** are illustrated in retracted position by full lines in FIG. 2 and in actuated position by dotted lines.

Means are provided for supporting the tamper units in fully retracted position, the crosspiece **26** on the frame uprights **27** being provided with hooks **28** which may be engaged with the lugs or keepers **29** connected to the tamper support member **15**. As stated, the carriage driving means is not illustrated.

In the embodiment illustrated, the carriage A is provided with a drive transmission and electrical and hydraulic mechanism within the housing **30**, and the controls referred to are positioned within and on the control stand **130** to be operated by an operator standing between the housing **30** and the stand. Jack means for facilitating the setting off of the tamper unit from the tracks is indicated by the numeral **31**, see FIG. 2, but as that has no functional relation to the operative parts it is not further described.

The sensor carriage B comprises a base frame **32** provided with pairs of wheels **33** mounted on axles **34**. The frame comprises pairs of laterally spaced tubular uprights **35**. Projecting upwardly from these frame uprights are posts **36** having threaded portions **37** telescoping within the uprights **35** provided with manually manipulated adjusting nuts **38**, the pairs of nuts being connected by the belts **39**. The sensor unit or units **40** are slidingly mounted for adjustment laterally of the track on the supporting beams **41** which are supportedly connected by the pivots **42** to the members **36**. A strut or brace member **43** is provided for the member **41** in the embodiment illustrated. The sensor members **40** are slidably mounted on the member **41**, being shown in one position by full lines and in adjusted positions by dotted lines.

A spirit level **44** is conventionally illustrated in FIG. 3 to depend centrally from the beams **41**. In the embodiment illustrated the sensor units **40** are pivotally mounted at **45** on the brackets **46** and secured in adjusted positions by the set screws **47**. This permits angular tilting adjustment in a vertical plane. The brackets **46** are U-shaped and have depending necks **146** (see FIG. 4) swivally adjustable in slides **147** slidably mounted on the support beams **41**. This permits angular adjustment of the sensor units in a horizontal plane as well as lateral adjustment transversely of the track.

The electric conductor cable, designated generally by the numeral **48**, is disposed through the conduits and the draft bar **7** connecting the sensor carriage to the tamper carriage and is connected to the meter **51**, conventionally illustrated in FIG. 2. The meter **50** is in convenient view of the operator facing the control stand **130**.

The light projector carriage C is provided with a base frame **52** provided with wheels **53** gauged to travel on the railway track. A platform or bed **54** is mounted on the axles **55**.

The upwardly converging upright standards **56** are provided with a collar or sleeve **57** at their upper ends with which the upright post **58** is slidably engaged, the post having a threaded portion **59** at its lower end supported in the base member **60**, a hand wheel **61** being rotatably mounted on this base member **60** and having a nut engaging the threaded portion of the post.

At its upper end the post **58** is provided with a crossbar **62** supported by the braces **63** mounted on the bracket **64** on the post **58** and connected to the bar **62** by means of the depending brackets **164**. The beam projector unit or units **65** are mounted for lateral sliding adjustment on the bar **62** and are provided with a plurality of beam projectors conventionally illustrated at **66**. This provides means for adjusting the beam projecting elements both vertically and laterally. An antenna **67** is mounted on these units, only one being illustrated. The light projectors **66** may be such as to produce or project visible or invisible rays.

The height scale indicating member **68**, conventionally shown in FIG. 5, has a flexible depending portion **69** terminating in the plumb bob **70** disposed above one of the rails. The adjustable height scale slides in a friction grip holder (not illustrated).

As stated, this third carriage C is remotely controlled and it is provided with a gas engine and generator **71** shown conventionally in FIG. 5, and with an electric driving motor **72**, also shown conventionally. This carriage C is provided with a radio control designated generally by the numeral **74** and receiving control signals from the antenna **67**. The driving means comprises the driven rollers or wheels **75** mounted on shafts **76** having driving connections to the motor **72**. The shafts **76** on which the driving wheels **75** are mounted are adjustable to and from driving position. The details of such adjustment are not illustrated as they form no part of the present invention.

The radio control **74** enables the positioning of the third carriage, or carriage C, by an operator on the first carriage and the variable positioning thereof, as there are no physical connections for the third carriage to the first carriage. A radio control and transmitter of a commercially available type may be mounted on the tamper carriage A as conventionally illustrated at **174** within reach of the tamper operator, or it may be carried by a track foreman alongside of the track to actuate the receiving control **74** and carriage C.

In the embodiment of our invention illustrated, the light projector units are mounted for horizontal adjustment as is illustrated in FIG. 4.

As stated, the light baffle boards **6** are mounted on the tamper carriage or unit and provided with slot-like openings **5** through which the beam of light, designated **4**, passes when the light projecting means and the baffle boards are positioned to properly direct the light beams to the sensor unit. These baffles **6** are mounted for vertical adjustment, being mounted on the crossbar **77** provided with tubular slides **78** mounted on the upright rods **79**, these rods being supported for vertical adjustment in bearings **80** on the carriage and **81** on the crossbar **28** at the top of the frame.

The slides **78** are provided with hand manipulated nuts **84** having engagement with the threaded portions **85** of the rods **79**. These members **79** are provided with track rail engaging wheels **86** at their lower ends. The wheels **86** necessarily follow the level of the rails so the baffle boards **6** and slots **5** adjustably carried by the crossbar **77** and sleeves **78** on the rods **79** will be at predetermined elevations above the rails. The meter **51** is conveniently mounted on the crossbar **77** where it will be in full view of the operator. With this arrangement of parts, the rails of a railway track may be accurately positioned as may be required with very little physical effort on the part of an operator positioned on the combined jack and tamper carriage.

As stated, the tamper carriage A may be, and is, structurally varied, for example, tamper carriages such as are now on the market may be used provided they include rail engaging jaws and packs and are provided with light baffle boards and the meter of the invention.

FIG. 6 schematically illustrates the electrical circuit of the light sensor unit **40** and the indicating meter **51**. The

sensor unit of the embodiment illustrated includes a battery **90** as a power source connected to the midpoint **91** of an upper circuit **92** and lower circuit **93**, each of which includes a plurality of similar light sensitive cells **94** connected in parallel to resistors **95**, **96**, **97** and **98**. The midpoint between the resistors **97** and **98** is connected to the opposite side of the battery as at **99** forming a balanced circuit which would normally pass equal current through both the upper and lower circuits **92** and **93**, see FIG. 6.

The sensor unit is highly desirable for use in this apparatus for the reason that it is insensitive or is not affected by ambient or stray light rays, as such rays of light strike all the light cells simultaneously, thereby leaving the balance between the groups of cells unaffected or unchanged. It will be appreciated that this is a highly important use feature, as stray or ambient light rays may have various sources.

The previously described connecting cable **48** is connected to each side of the balanced circuit between the resistors **95–97** and between the resistors **96–98** to compare but not necessarily or actually measure the current flowing in the two circuits. Thus when the circuits are balanced the pointer **100** of the meter will indicate a midpoint or balanced condition, but any unbalance in the electrical circuits will cause the indicator to swing to either the high or low indicia readings illustrated.

The light sensitive cells **94** are of the type which change resistance in response to the intensity of light directed against them. Plural cells **94** are used on each of the upper and lower circuits **92** and **93** in order to integrate minor variations in the resistance of different cells and to integrate or neutralize the effect of stray light which may strike the sensor unit.

In operation of the apparatus described, the light source carriage C is advanced along the track 200 or 300 feet ahead of the jack and tamper carriage A by means of the radio controls **74** and **174** and is preferably located by visual observation of the operator on a high point of the irregular track. The sensor carriage B is, of course, maintained at a constant distance behind the tamper carriage A by the draft bar **7**. The absolute elevation of the light source **66** on the carriage C is selected and adjusted by means of the hand wheel and nut **61** for the particular operation to be performed, and the light source is energized continually from the engine generator unit **71** to direct an intense light beam **4** rearwardly toward the sensor unit **40**. The elevation of the sensor unit **40** is adjusted by means of the hand wheels **38** and when operating on straight level track is normally adjusted to the same absolute level as the level of the light source **66**. However, when operating on long grades or when it is desired to purposely establish a uniform gradient in the track, the relative elevations of the light source and the light sensor may be purposely differentiated to predetermined degrees.

With the position but not necessarily the absolute level of the light beam **4** established by the source **66** and sensor **40** the elevation of the crossbar **77** and the light baffle boards **6** on the tamper carriage A is adjusted so that the top of the rails **2** will be at the desired elevation and selected distance below the light beam when the slit **5** in the baffle board is at a level to pass the light beam. Assuming the rail to be below the desired level at the jack and tamper carriage A, the operator actuates the jack and tamper controls to grip the rails with the jaws **23** and depress the jacks **18**, thus lifting both the carriage A and the rails. As the rail is elevated the rods **79** and rollers **86** correspondingly elevate the crossbar **77** and raise the baffle board **6** across the light beam **4** resulting in a differential in light intensity applied to the several light sensitive cells **94**. As the slot **5** moves into coincidence with the level of the light beam **4**, the same intensity of light will be directed onto both the upper and lower series of cells resulting in balancing of the circuits **92** and **93** and centering of the indicator needle **100**. This indicates to the operator the correct elevation of the rail and the operation of the jacks **18** is stopped while the ballast underneath the tie at the point raised is tamped in place. The jack and tamper carriage A is then advanced without moving the light source carriage C and the procedure repeated to progressively raise the track to the desired level. It will be understood that the leveling operation is performed only at intervals of eight to twelve ties and that intervening portions of the rails are later supported and stabilized at the new level by other tamping mechanism which follows the jack tamper. During progressive leveling of the track the light sensing unit on carriage B is supported on the newly leveled track to maintain a constant reference point with respect to the light source **66**. When the jack and tamper carriage A has advanced into close proximity to the light source carriage C the carriage C is advanced to a new reference point further along the ungraded track.

When it is desired to align or even the grade of the rails along a plane other than a true horizontal plane, the elevation of the light source can be adjusted with the result that the jack and tamping carriage moves the rails to the predetermined distance below the light beam which is then inclined upwardly or downwardly from the sensor unit **40**, depending upon the adjustment made.

We have illustrated and described our invention in a highly practical embodiment thereof. We have not attempted to illustrate or describe various modifications and adaptations to different tamper units, as it is believed that this disclosure will enable those skilled in the art to embody or adapt our invention as may be desired.

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

1. In a control system for a railroad ballast tamper having jacks and rail hooks for shifting the position of the track, the combination comprising, a first carriage having a light source visible at said tamper, a light sensor coupled to said tamper and mounted to be held at a predetermined dimension from said track, a baffle supported on said tamper between said light source and said light sensor, said baffle having a slot disposed transversely to said dimension and being mounted relative to said track so that said slot moves parallel to said dimension as the jacks shift the track, said sensor including a plurality of light responsive cells disposed parallel to said dimension and facing said light source, and a circuit coupling said cells so that a circuit output is obtained whose direction and magnitude is determined by where the light passing through said slot from said source strikes said sensor.

2. An apparatus for alining railroad track comprising, in combination, a drivable tamper adapted to ride along said track and having manually controlled jacks and rail hooks for shifting the track on which the tamper rides, a first buggy adapted to ride on said track ahead of said tamper, a second buggy adapted to ride on said track behind said tamper, means for moving said buggies along the track, a light source mounted on one of said buggies to direct light toward said tamper, a light sensor mounted on the other of said buggies and aimed to receive light from said source, a baffle mounted on said tamper and having a slot movable with said shifting track, said slot creating a beam of light from said source which moves across said sensor as said tamper shifts the track and said baffle, and means responsive to the position of said beam on said sensor for indicating that position to an operator on said tamper.

3. The combination of claim **2** in which said source is on said first buggy and said sensor is on said second buggy.

4. The combination of claim **2** in which said means for moving said buggies includes a draft rod between said tamper and said second carriage and a radio controlled motor on said first carriage.

5. The combination of claim 2 in which said sensor includes a plurality of light responsive cells, and said last named means includes a circuit coupling said cells so that a circuit output is obtained whose direction and magnitude is determined by where said light beam strikes the sensor and is thus capable of indicating the beam position on the sensor to an operator on the tamper.

References Cited by the Examiner

UNITED STATES PATENTS

2,962,979	12/1960	McCormick	104—7
3,000,099	9/1961	Hayes.	
3,012,469	12/1961	Clayborne.	
3,041,982	7/1962	Plasser et al.	104—7
3,050,015	8/1962	Talloys	104—2
3,144,834	8/1964	Stewart	104—7
3,153,389	10/1964	Plasser et al.	104—7
3,177,813	8/1965	Stewart	104—12

ARTHUR L. LA POINT, *Primary Examiner.*

LEO QUACKENBUSH, *Examiner.*

M. J. HILL, R. A. BERTSCH, *Assistant Examiners.*