Dec. 22, 1931. E. A. SPERRY 1,837,633

ROADWAY INSPECTING MEANS

Filed Oct. 12, 1928 2 Sheets-Sheet 1

Fig. 1.

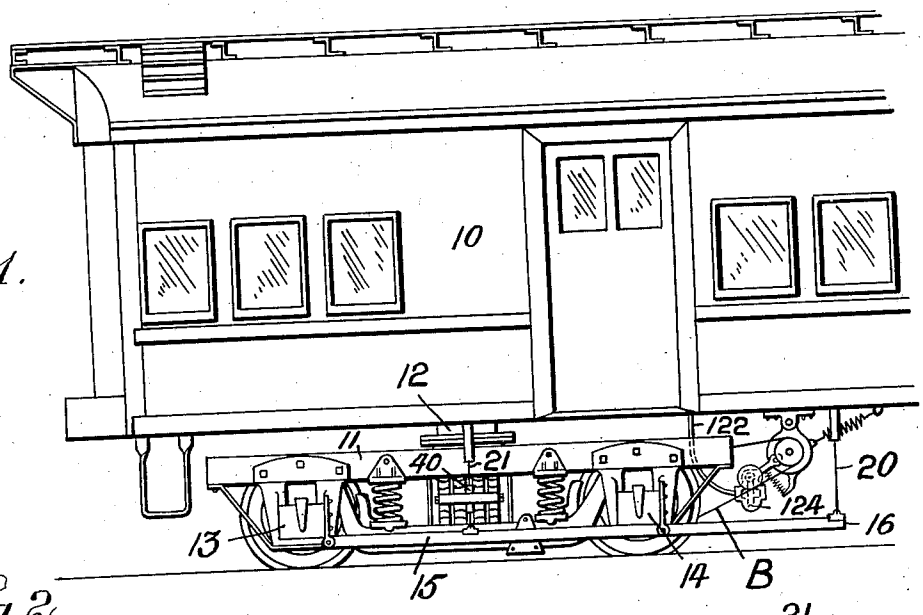


Fig. 2.

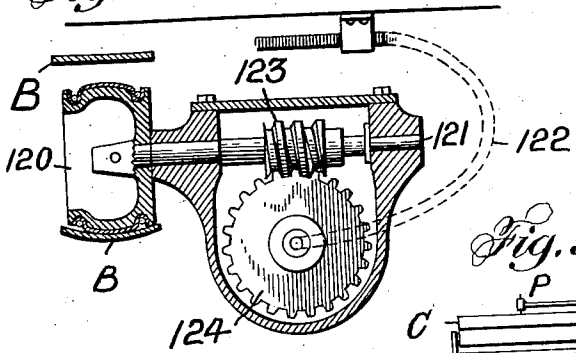


Fig. 4.

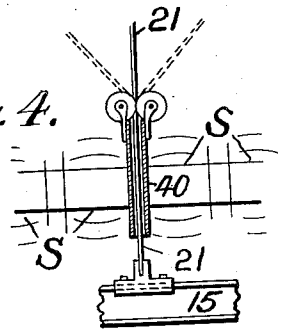
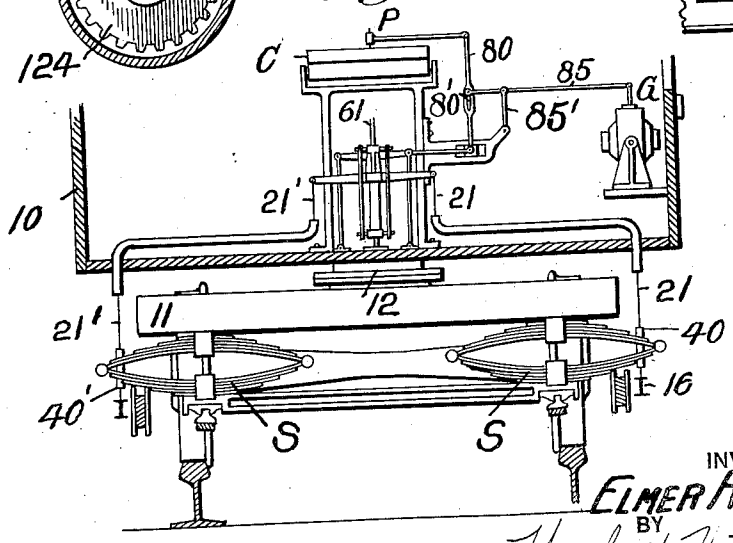


Fig. 3.



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Fig. 5.

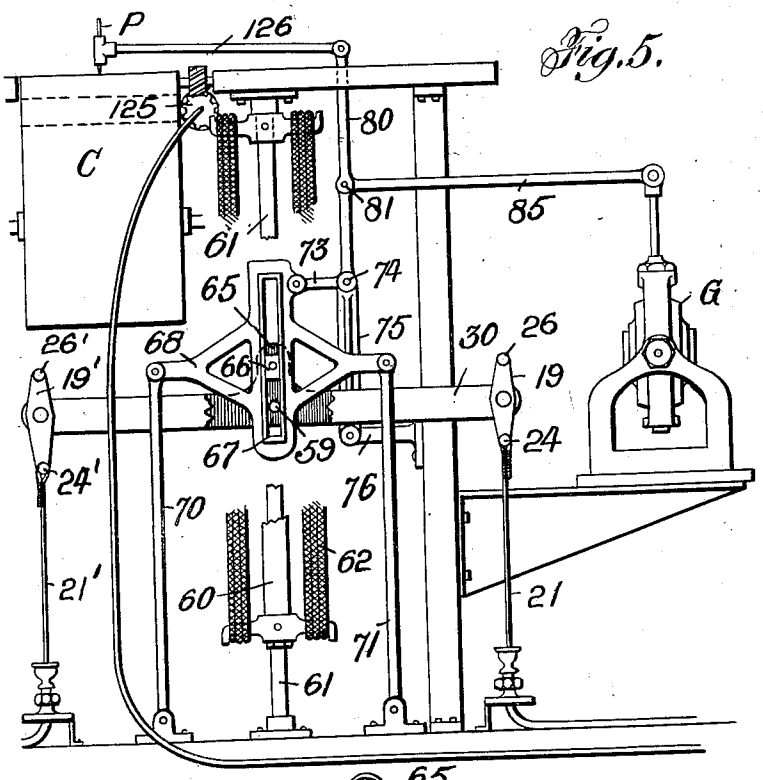
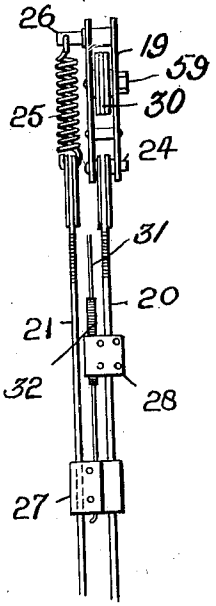


Fig. 7.



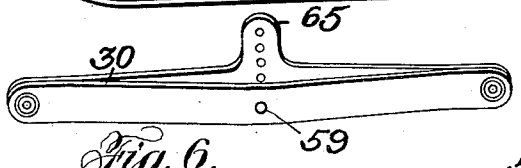
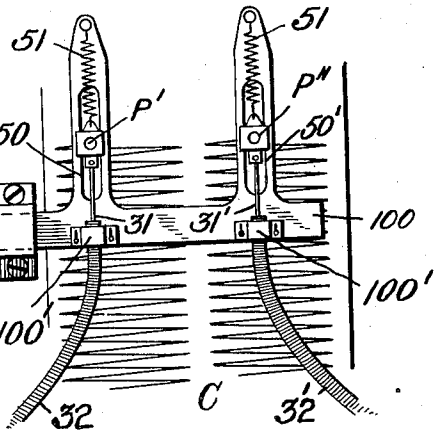


Fig. 6.

Fig. 8.



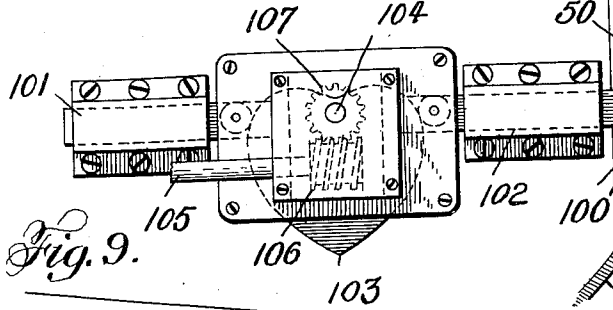
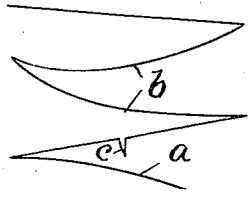


Fig. 9.



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UNITED STATES PATENT OFFICE

ELMER A. SPERRY, OF BROOKLYN, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SPERRY PRODUCTS, INC., OF BROOKLYN, NEW YORK, A CORPORATION OF NEW YORK

ROADWAY INSPECTING MEANS

Application filed October 12, 1928. Serial No. 312,019.

This invention relates to roadway inspecting means and has for its principal object the provision of improved means for determining and indicating differences in elevation between the tracks and differences in elevation along each track. The latter mechanism will, of course, include means for determining low rail joints since this forms one of the principal differences in level in any track, but in addition this mechanism will also indicate depressions or elevations in any form of roadway or track due to failure of the supporting medium or to unequal yielding of said medium under load.

It is a further object of this invention to provide recording means which may be adjusted to move in any desired ratio to the actual differences in elevation.

Other objects of this invention more or less broad than those stated above will be pointed out or will become apparent in the following detailed description of the invention.

In the accompanying drawings:

Fig. 1 is a side elevation of a portion of a railroad car equipped with my invention.

Fig. 2 is a vertical section through a portion of a flexible cable drive.

Fig. 3 is a vertical section of the Fig. 1 device.

Fig. 4 is an enlarged detail showing a means for preventing the indicator operating cables from engaging the spring mechanism of the car truck.

Fig. 5 is a rear elevation of a portion of the indicating mechanism within the car with a modified pen-operating linkage.

Fig. 6 is an enlarged detail of the actuating bar employed in Fig. 5.

Fig. 7 is a side elevation of the cables for actuating an indicator.

Fig. 8 is an elevation of the means for recording differences in elevation longitudinally along the roadway or track.

Fig. 9 is a view of a portion of a rail level record.

While my invention is described hereinafter principally in connection with the tracks of a railroad, it should be understood that this is merely illustrative of the uses to which the invention may be put, but the invention applies broadly to measuring the longitudinal undulations of any form of road-bed as well as the rails of a railroad. This will become apparent in the following description of the invention.

Referring to Fig. 1 of the drawings, there is shown a car body 10 mounted upon the usual pair of trucks, one only being shown as the so-called "bogy" or car truck 11, said truck being pivotally connected to the car body by pivot post 12. The axles of the wheels are supported within journal boxes 13—14 in the usual manner, said journal boxes being slidable vertically with respect to the car truck. Said vertical sliding movement is utilized herein for the purpose of indicating differences in elevation in a track. For this purpose I may fasten to said journal boxes a beam 15 having one end 16 projecting beyond the axle centers to a predetermined distance. Thus, when a low rail joint or low stretch of track or road-bed is encountered, the forward journal box 14 will drop with respect to the rear journal box 13 and this movement will be taken up by the extended arm 16. For obtaining an indication of the movement of one journal box with respect to the other, I prefer to employ a pair of wires 20, 21 connected to beam 15 at spaced points, and I utilize the differential movements of the two wires with reference to a base-line, in this case, the spring-suspended car-body to impart movement to an indicator pen. The points of connection of said wires to said beam are such that the differential movements of said wires may bear any desired relation to the actual differences in elevation in a track. For this purpose I cause one of said wires, such as 20, to be anchored to one end 24 of a rocker 19 pivotally mounted on one end of a bar or lever 30, and the other wire 21 to be connected through a yielding connection 25 to a point 26 on said rocker in vertical alignment with the point 24 to which wire 20 is connected. Upon encountering a low rail joint or a low or high portion of the track, it will be seen that wires 20 and 21 will pull unequally upon the end of bar or lever 30, owing to the spring connection of one of said wires, and this rela-

tive movement between such wires is caused to impart movement to an inner wire 31 fixed to wire 20 by bracket 27 and moving through the outer bowden sheath 32 fixed to wire by bracket 28. Said wire 31 is connected to a pen P′ to be described more fully hereinafter. I may provide a sheath 40 adjacent the spring sections S of the car truck to prevent the wire 21 from striking said springs during turning movements when the wire would ordinarily take up positions such as those shown in dotted lines in Fig. 4.

At the other side of the truck there is a similar arrangement to that hereinbefore described with a second wire 31′ being caused to actuate a second pen P″ in juxtaposition to said first pen P′ as will be described more fully hereinafter.

Said pens P′ and P″ are carried by a pen-holder 100 adapted to be reciprocated laterally with respect to chart C within guides 101, 102 by a cam 103 pivoted at 104 adapted to be constantly driven from the car wheels by means including a flexible cable 105 and gearing 106, 107. The constant rotation of said cam causes said pen-holder to be oscillated back and forth across the chart C which is likewise constantly driven linearly so that there is formed a zig-zag path down said chart which gives a magnified indication relative to the actual length of rail traversed. If no low or high spots are encountered, wires 31 and 31′ will not be actuated and said pens will, therefore, describe a zig-zag path comprising straight, inclined lines. If, however, a high or low portion of the rail is encountered, wire 31 or wire 31′ or perhaps both, if both rails are out of level, will be actuated with corresponding actuation of the pens longitudinally with respect to chart C within longitudinal slots 50, 50′ formed in the pen-holder 100, and against the restoring action of springs 51, so that the inclined lines will no longer be straight but will be curved upwardly or downwardly as shown at *a* and *b* in Fig. 9. A sharp break, such as *c*, in the line indicates a rail joint while a gradual curve upwardly or downwardly indicates a depression or elevation in the respective track other than the rail joint.

I may utilize a portion of the same mechanism hereinbefore described for indicating differences in elevation between the tracks, or the different sides of a road-bed, for if there are differences in elevation between the tracks or sides, cables 20 and 21 as a unit at one side and the cables 20′ and 21′ as a unit at the other side are actuated (the cables 31 and 31′ may also be actuated at the same time if there are elevations or depressions in each track as well as differences of elevation between the tracks) to cause a rocking movement of the lever 30. Said lever may be pivoted upon a sleeve 60 slidable upon a fixed post 61, said sleeve being normally placed under tension by a plurality of resilient bands 62 or equivalent (see Fig. 5) to cause the lever 30 to be drawn upwardly to maintain the cables at each side under tension regardless of the behavior of the car-body on springs S. Said lever 30 may be provided with a crank arm 65 having a sliding block 66 operating in a slide 67 within a member 68 that is mounted for parallel movement laterally, that is, to the right or left whenever arm 30 is rocked about the pivot 59. Said parallel mounting may comprise a plurality of links 70—71 pivoted at one end on the fixed support and at the other end to said member 68, said member 68 being held in position by means such as an arm 73 pivoted at 74 upon a link 75 mounted on a fixed bracket 76. Rocking of lever 30 about pivot 59 will cause lateral movement of member 68 to rock a lever 80 about a pivot 81 which is held in fixed stabilized position through a gyroscope G connected to said lever 80 at 81 by a link 85. Such rocking movement of lever 80 about pivot 81 will operate a pen P across a record chart C. It will be seen that only differences in elevation between the tracks will rock lever 30 about pivot 59, for if both tracks rise or fall to the same degree no rocking of lever 30 about pivot 59 will take place, and hence there will be no actuation of pen P, although in such a case the wires 31 and 31′ would be actuated to cause pens P′ and P″ to indicate high spots in the respective tracks.

The drive for chart C and the cam 103 may be taken off the belt B which drives the usual generator on railroad cars and said drive may comprise the pulley 120, the shaft 121 of which drives a flexible cable 122 through gearing such as 123, 124. Said cable 122 may drive chart C through skew gear 125 and worm 126. The drive for cam 103 may also be taken off cable 122, said cable being provided with an extension 105 beyond gear 125 and carrying gear 106 meshing with gear 107.

The object of the gyro G is to prevent any rocking motions of the spring-supported car-body 10 from influencing the record of pen P, compelling complete integrity with the road-bed variations by neutralizing all car motions which are independent of the road-bed inequalities. In the Fig. 3 form of the invention there is provided a slot 80′ in the lever 80, the purpose of which is to allow the pivot point to change its position on the lever 80 by the swinging of link 85′. This performs an important function in neutralizing the accumulated parallax of the levers or foreshortening of the indications when they swing either side of their true normal or vertical positions, thus preventing distortion in the indications and records of the true road-bed inequalities as to their exact lateral or cross levels.

The length of the unguided portion of cable 21 between truck supported parts 15—16 and car body 10 is less than that of cable 20. These lengths bear approximately a true proportion to their respective distances from the pivotal center 12 of the truck 11. This insures accuracy of indications when the truck 11 has been swivelled away from true alignment with the car body.

The clamps 100′ for the bowden casings are for the double purpose of adjusting the position or location of the end of the casing with respect to the pen-slides to bring the latter in proper alignment as well as to retain the casing when so adjusted.

In accordance with the provisions of the patent statutes, I have herein described the principle and operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combination and relations described, some of these may be altered and others omitted without interfering with the more general results outlined, and the invention extends to such use.

Having described my invention, what I claim and desire to secure by Letters Patent is:

1. In an inspection device for detecting inaccuracies in the surfaces of road beds, means whereby the surface differences are determined in different ratios with respect to a common base, an indicator, and means whereby said indicator is operated by the differential of such ratios as the device passes along the said road bed.

2. In an inspection device for detecting inaccuracies in the surfaces of road beds, means whereby the surface differences are determined in different ratios with respect to a common spring-supported base, said means including non-resilient connections to said surfaces, an indicator, and means whereby said indicator is operated by the differential of such ratios as the device passes along said road bed.

3. In an inspection device for detecting inaccuracies in the surfaces of road beds, means whereby the surface differences are determined in different ratios with respect to a common base, a swiveling truck, said means including connections from said truck to said surfaces, said connections being positioned at different distances from said swivel and of different lengths in proportion to said distances, an indicator, and means whereby said indicator is actuated by the differential movements of said connections as said device passes along said road bed.

4. In an inspection device for detecting inaccuracies in the surfaces of road beds, means responsive to said inaccuracies, an indicator, means whereby said indicator is actuated by said first means, said first means including a plurality of swiveling levers, and means for neutralizing the distortion due to the angular positions of the levers between said road bed and said indicator.

5. In an inspection device for detecting inaccuracies in the surfaces of road beds, means whereby the surface differences are determined in different ratios with respect to a common base, an indicator, and means whereby said indicator is operated by the differential of such ratios as the device passes along the said road bed, said last-named means including a bowden wire connection comprising an inner wire and a surrounding sheath.

6. In an inspection device for detecting inaccuracies in surfaces of road beds, means for indicating differences in elevation in a surface, said means including a "bogy" truck having on each side two journal boxes responsive to differences in elevation of the said surface, a member connected to said journal boxes and having one end extending beyond one of said boxes, and means connected to said member on opposite sides of one of the journal boxes and extending to said indicating means, and means whereby said connections actuate said indicator differentially.

7. In an inspection device for detecting inaccuracies in the surfaces of road beds, means for indicating differences in elevation in the surface, said means including a chart, means for driving said chart continuously in a longitudinal direction, a pen for recording on said chart, means for continuously oscillating said pen laterally of the chart, means responsive to differences in elevation in the surface, and means whereby said responsive means actuates said pen to vary the contour of the line normally traced by said pen.

8. In an inspection device for detecting inaccuracies in the surfaces of road beds, means for indicating differences in elevation in the surface, said means including a chart, means for driving said chart continuously in a longitudinal direction, a pen for recording on said chart, means for continuously oscillating said pen laterally of the chart, means responsive to differences in elevation in the surface, and means whereby said responsive means actuates said pen longitudinally to vary the contour of the line normally traced by said pen.

9. In an inspection device for detecting inaccuracies in the surfaces of road beds, said device including a "bogy" truck having forward and rearward journal boxes responsive to differences in elevation of the surface, a member connected to said journal boxes and having one end extending beyond said boxes, a recorder, a pair of connections between said recorder and spaced points on said member on opposite sides of one of said

journal boxes, and means whereby said recorder is actuated by the differential movements of said connections, said last-named means including a bowden wire having the two parts thereof connected to said respective connections.

10. In an inspection device for detecting inaccuracies in the surfaces of road beds, in combination, means responsive to differences in elevation in one surface, means responsive to differences in elevation in another surface, and means operated differentially by said first two means for indicating differences in elevation between said surfaces.

11. In an inspection device for detecting inaccuracies in the surfaces of road beds, in combination, means responsive to differences in elevation in one surface, means responsive to differences in elevation in another surface, a lever pivotally and slidably mounted, said first two means being attached to the respective ends of said lever whereby said lever is rocked only by differential movements of said first two means, a recording pen, and means whereby rocking movements of said lever actuates said pen.

12. In an inspection device for detecting inaccuracies in the surfaces of road beds, in combination, means responsive to differences in elevation in one surface, means responsive to differences in elevation in another surface, a lever pivotally and slidably mounted, said first two means being attached to the respective ends of said lever whereby said lever is rocked only by differential movements of said first two means, a recording pen, and means whereby rocking movements of said lever actuates said pen, said last-named means including a parallel motion linkage.

13. In an inspection device for detecting inaccuracies in the surfaces of road beds, in combination, means responsive to differences in elevation in one surface, means responsive to differences in elevation in another surface, a lever pivotally and slidably mounted, said first two means being attached to the respective ends of said lever whereby said lever is rocked only by differential movements of said first two means, a recording pen, and means whereby rocking movements of said lever actuates said pen, said last-named means including a parallel motion linkage and means whereby said linkage operates said pen, including a pivotal mounting for said pen and gyroscopic means for stabilizing the pivot thereof.

14. In an inspection device for detecting inaccuracies in the surfaces of road-beds, said device including a "bogy" truck having forward and rearward journal boxes at each side responsive to differences in elevation in the respective surfaces, a member at each side connected to the journal boxes on that side and having one end extending beyond said boxes, a traveling chart, a pair of connections attached to each of said members on opposite sides of one of said journal boxes at each side to respond differentially to differences in elevation of the respective surfaces, and means operated by the differential movement of said two pairs of connections to indicate on said chart differences in elevation between the two sides.

In testimony whereof I have affixed my signature.

ELMER A. SPERRY.