APPARATUS FOR DETERMINING A DESIRED LEVEL OF A TRACK SECTION TO BE RAISED
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The present invention relates to track grading, and more particularly to improvements in apparatus for accurately determining a desired track level and raising the track to such a level.

It has been proposed to use an elongated, flexible tension member, for instance a wire, extending along a track section to be raised in systems of this type. For instance, it has been proposed to attach one end of such a reference wire to a fixed anchor point adjacent one end of the track section to be raised and to mount the other anchor point of the reference wire on a mobile track tamper which continuously approaches the fixed anchor point as the track grading operation proceeds over the track section. The length of the wire is thus continuously shortened during the operation and the wire is wound on a tension roll behind its anchor point to keep it under substantially constant tension. The lifting stroke parameter is determined in reference to the tensioned wire ahead of the track tamper.

Grading systems of this type lack desirable accuracy because a certain amount of sag of the tensioned wire over the track section to be raised is unavoidable. If no account is taken of such sag, the track section will depart from level in accordance with the wire sag. It is the primary object of the present invention to overcome this disadvantage and to provide accurate grading in the described system.

This and other objects are accomplished in accordance with this invention by measuring the amount of sag of the tension member portion in registry with the point of the track section to be raised, adding this amount to the lifting stroke parameter and raising the track section at this point by the sum of the amount of sag and the lifting stroke parameter.

Preferably, the constantly shortened tension member is held under a constant tension and the amount of sag is simply empirically measured in accordance with the tension of a tension member having given physical characteristics and a given length.

 Arbitrarily allowing for the error in the lifting stroke parameter caused by the sag in the wire may, in practice, cause considerable time losses in the grading operation if the operator has to make the proper adjustment at each point of the track section to be raised. This would greatly interfere with an efficient and economical grading operation.

In accordance with this invention, therefore, we provide apparatus for carrying out the described method, such apparatus comprising a vertical measuring element at a point of the track to be raised and measuring the distance between this point and the tension member, and means adjusting the length of the measuring element in accordance with the amount of sag of the tension member portion in registry with this point.

The above and other objects, advantages and features of the present invention will be more fully explained in the following detailed description of a specific embodiment thereof, taken in conjunction with the single FIGURE of the accompanying drawing showing a schematic side view of an apparatus for determining a desired level of a track section to be raised, some elements being disproportionately enlarged to clarify significant features of the invention.

A preferred track grading apparatus to which this invention may usefully be applied is fully disclosed and claimed in our copending application Serial No. 27,578, filed May 9, 1960. In view of this full disclosure of preferred track grading apparatus, the description of the invention will refer only to such parts of the apparatus as are directly connected with the elements of the present invention. The track correction means, for example, consists of hick gripping means and track jacks, for instance, has not been shown at all and the track tamper is only schematically indicated since the invention is not concerned with these features.

Referring now to the drawing, there is shown the front part of a mobile track tamper carriage 1 with a forwardly projecting support bracket 2 carrying a vertical measuring element 8, 8'. As conventional, the tamping tools 13 are mounted forwardly of the front wheels 2 of the track tamper so that the front wheels travel on a finished track section which has been fixed at the desired level.

Idler roller 5 is mounted on vertical rod 14 and forms one anchor point for the elongated, flexible tension member 3 which is a wire in the illustrated embodiment. The other anchor point for wire 3 is constituted by a hook 16 to which an end of the wire is attached. The anchor point 16 is mounted on a vertical frame 4 mounted on a mobile wagon 19 running on track 12 ahead of the track section to be raised. The vertical spacing of the two anchor points of the wire from the track is identical so that the tensioned wire serves as a reference determining the lifting stroke parameter for the raising of the track section between the two anchor points. During the grading operation, anchor point 16 is held in fixed position while the track tamper 1 advances from tie to tie toward wagon 19, thus progressively shortening the length of the wire 3 while portions thereof sag from the straight line indicated by dot-and-dash lines to the sagging wire line indicated in full line. To obtain accuracy in grading, the reference line should be straight so that the track to be raised in parallel thereto may be equally level. Since, in practice, the tension member sags, allowance is made for this sagging when the track is raised in accordance with this invention.

While one end of the wire 3 is attached to hook 16, the other end is engaged by winding roll 6 to impart a constant tension to the wire as anchor point 5 advances toward anchor point 16. According to the invention, a drive means is operatively connected with the winding or tension roll 6, the illustrated drive means comprising essentially a rack-and-pinion mechanism consisting of pinion 7 meshing with rack 8', the pinion being connected with the tension roll by means of belt 15.

The vertical measuring element, which is positioned at the point of the track section to be raised, comprises parts 8 and 8' which are interconnected by means of a cam 10. The end of the element adjustable. Part 8' carries a roller on its lower end to engage the track 12. The upper end of measuring element part 8' supports a housing 17 for the cam disc 9, upper measuring element part 8 being engaged by the cam disc and being adjustable positioned in relation to part 8' by the cam disc. Part 8 is in contact with or rides against wire 3.

In the illustrated embodiment, cam disc 9 is driven by a rack-and-pinion mechanism, the cam disc being mounted on pinion 18 meshing with rack 11. Rack 11 is operatively connected with and driven by drive means 7, 7', the illustrated connection being a linkage system 10 connecting racks 7' and 11. Thus, the cam disc is driven in synchronism with pinion 7 which, in turn, is rotated by tension roll 6 as the tensioned tension member 3 is wound thereon during the progress of the grading operation.
The larger the sag of the tension member the lower is the measuring element part 8 so that the varying length of the measuring element fully equalizes the wire sag, the cam disc controlling the measuring element length adjustment according to the empirically measured amount of sag.

The cam disc is so marked and adjusted that it may be brought into an initial operating position corresponding to the distance between anchor points 5 and 16. Thus adjusted, its rotation and corresponding adjustment function develops automatically.

In operation, the track section is raised to a desired level by extending the elongated, flexible tension member along the track section and vertically spaced therefrom from anchor point 16 to idler roller 5. A tension is exerted on the member 3 by winding it on roll 6 and simultaneously shortening the length of the tension member as the raising of the track section proceeds. The tensioned tension member serves as a reference and determines the lifting stroke parameter for the raising of the track section but the tension member sags from its straight line and the amount of sag of any tension member portion in registry with a point of the track section to be raised is, therefore, measured in accordance with this invention and this amount is added to the lifting stroke parameter. The track section is then raised at this point by the sum of the amount of sag and the lifting stroke parameter.

While the method and apparatus of this invention have been described in connection with a specific embodiment, it will be understood that many variations and modifications may occur to the person having ordinary skill in the art, particularly after benefiting from the present teaching, without departing from the spirit and scope of this invention as defined in the appended claims.

What we claim is:

1. An apparatus for determining a desired level of a track section to be raised, comprising (a) an elongated, flexible tension member extending along the track section and vertically spaced therefrom, (b) two anchor points for said tension member adjacent the respective ends of said track section, one of said points being movable in relation to the other one as the raising of the track section proceeds whereby the length of the tension member is shortened, (c) a tension roll for winding the tension member thereon under a substantially constant tension, said tensioned tension member serving as a reference and determining the lifting stroke parameter for the raising of the track section and portions of said tension member sagging, (d) a drive means in operative connection with and driven by the tension roll, (e) a longitudinally adjustable vertical measuring element at a point of the track section to be raised and measuring the distance between the track section and the tension member, (f) means for adjusting the length of the measuring element in accordance with the amount of sag of the tension member portion in registry with said point, and (g) means operatively connecting said drive means and said measuring element length adjusting means whereby the tension member length automatically adjusts the measuring element length.

2. The apparatus of claim 1, wherein said drive means is a rack-and-pinion mechanism.

3. The apparatus of claim 1, wherein said measuring element length adjusting means comprises a rotatable cam disc driven by said drive means.

4. The apparatus of claim 3, further comprising a rack-and-pinion mechanism operating said rotatable disc, the latter mechanism being driven by said drive means.

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