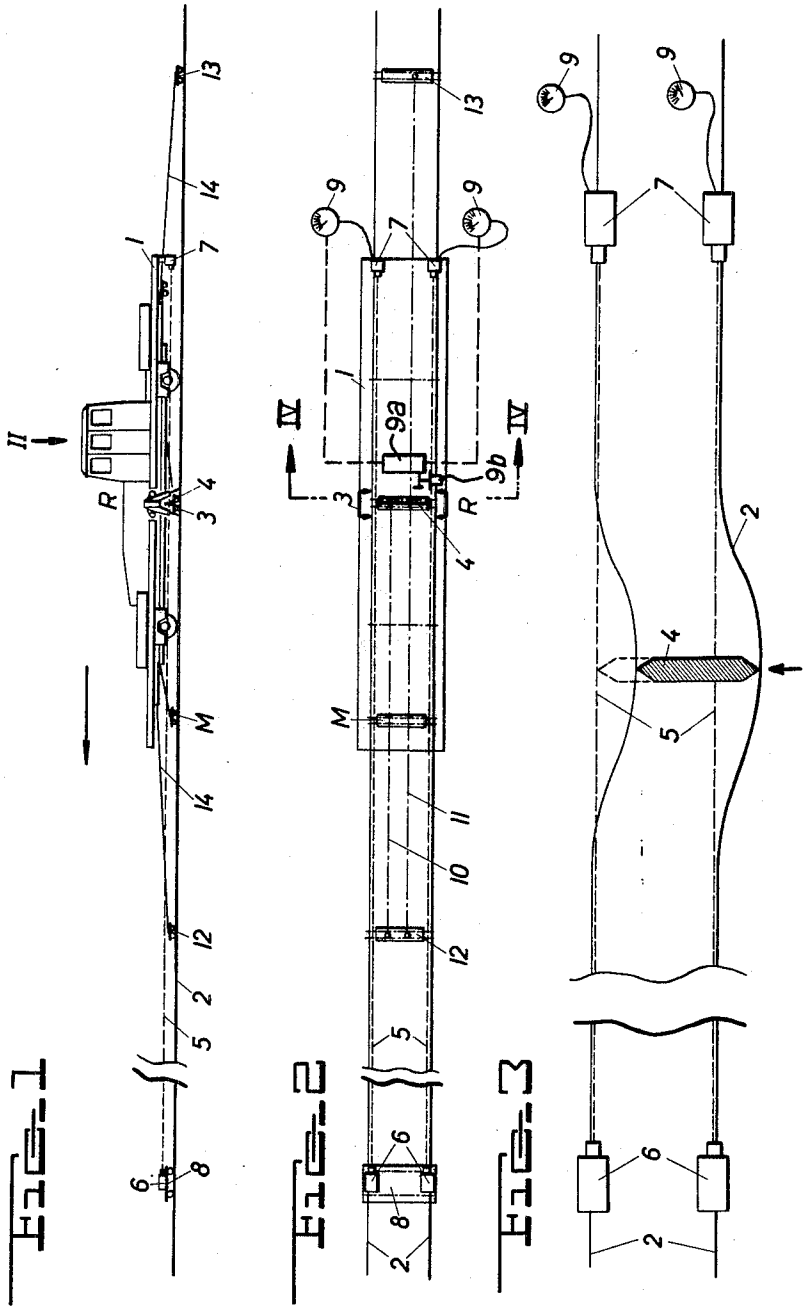
March 17, 1970 F. PLASSER ETAL 3,500,762

APPARATUS FOR INDICATING AND/OR PRODUCING LATERAL TRACK ALIGNMENT

Filed Aug. 21, 1967 2 Sheets-Sheet 1



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Filed Aug. 21, 1967 2 Sheets-Sheet 2

FIG. 4

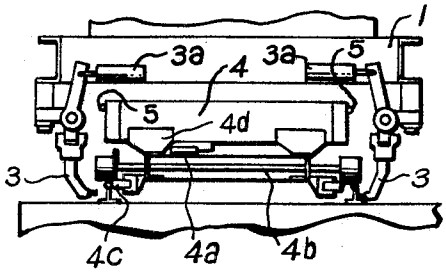
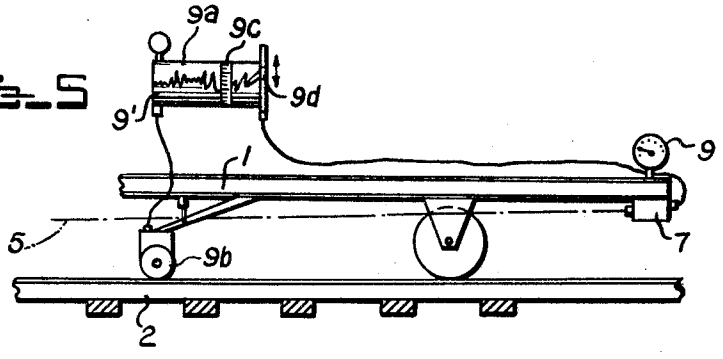


FIG. 5



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APPARATUS FOR INDICATING AND/OR PRODUCING LATERAL TRACK ALIGNMENT

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U.S. Cl. 104—8
11 Claims

ABSTRACT OF THE DISCLOSURE

In track alignment operations, a beam of radiant energy is used as a reference line and a laterally movable stop is arranged at a track rail point to be aligned. The lateral position of the stop in respect of the reference line beam measurably changes the intensity with which the beam is received by a receiver mounted behind that point. This change in intensity is used to indicate the misalignment of the point.

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to apparatus for indicating the lateral alignment of a track rail point in respect of an associated reference line, and for aligning the track.

In track grading, i.e. the vertical repositioning of tracks, it has been found most useful to use beams of radiant energy for reference lines. Such reference line beams are arranged above the track rails and stops, which are supported on the rails and move vertically with them, cooperate with the beams so that, when the stop moves into the path of an associated beam, the proper grade of the track is indicated. The resultant signal is used to terminate the grading operation, i.e. to stop lifting the track.

Such beams of radiant energy have not been used heretofore as reference lines for the lateral alignment of tracks because it was felt that it was not possible accurately to operate with stops which move horizontally transversely of the track. Therefore, the conventional reference lines for lateral alignment of tracks were tensioned wires. Such wires have, however, a number of disadvantages, such as sagging, a tendency to vibrate, etc., and difficulties in maintaining the tensioning of the wires during continuous operations.

It is, therefore, a primary object of this invention to make the beams of radiant energy, which have been found to be so successful in track grading, useful as reference lines in lateral track alignment.

This and other objects are accomplished in accordance with the invention by mounting a laterally movable stop at the track rail point to be aligned, whose lateral position in respect of the reference line beam measurably changes the intensity with which the beam is received at a receiver.

If the apparatus is used for track alignment, it comprises a track alignment means at this track rail point and the stop is laterally movable in unison with the track alignment means. Such an apparatus advantageously comprises a frame mounted on wheels for mobility on the track rails in a manner which is conventional in track liners. The track alignment means is mounted on the frame intermediate the wheels, and the reference line beam receiver is mounted on the frame at the rear end thereof, in the direction of operation. When the track alignment means engages the track during track alignment and moves it laterally, the stop moves in unison therewith.

While the apparatus is particularly useful in straight track section, certain modifications therein make it also operable in the alignment of track curves.

BRIEF DESCRIPTION OF DRAWING

The above and other objects, advantages and features of the present invention will become better understood by reference to the following detailed description of a specific embodiment thereof, taken in conjunction with the accompanying drawing wherein

FIG. 1 is a side view of a track aligning apparatus according to this invention, the horizontal arrow indicating the direction in which the apparatus moves on the track during alignment operation;

FIG. 2 is a top view of FIG. 1 in the direction of arrow II;

FIG. 3 is a greatly exaggerated schematic view of the operation of the stop at a track rail point whose lateral position is to be indicated or aligned;

FIG. 4 is a section along line IV—IV of FIG. 2 and shows an embodiment of the track alignment means and mounting of the stop; and

FIG. 5 shows a detail.

DETAILED DESCRIPTION

Track aligning machines of the general type herein described and illustrated being well known, only as much of the conventional machine parts have been shown and will be described as are required to understand the use of the laterally movable stop of this invention in combination with its cooperating parts.

As shown, the apparatus includes a carriage or frame **1** mounted on wheels for mobility on the track rails **2**. Suitable track alignment means **3** is mounted on the frame for laterally moving the track in a selected direction transversely of the track. The track alignment means illustrated by way of example in FIG. 4 includes a pair of levers **3**, **3** arranged selectively to engage a respective one of the track rails when the lever is moved into rail engagement (as at the right in FIG. 4) by its hydraulic motor **3***a* to move the track laterally in the opposite direction. Obviously, the hydraulic motors may be replaced by any suitable drive means. The track alignment means move the track laterally at a track point R to be aligned. The invention is not concerned with the type of track alignment means used.

As also known by way of example in FIG. 4, a laterally movable stop **4** is arranged to track point R to move in unison with the track alignment means. As illustrated, the stop is a transversely extending element mounted on carriage **4***b* which has wheels supporting the carriage for mobility on the track and for movement with wheeled frame **1**. Rail engaging elements **4***c*, **4***c* are mounted on each side of the carriage **4***b* adjacent a respective one of the track rails so that the carriage may be held against the selected rail during an alignment operation, depending on the direction in which the track is to be moved for alignment. The stop **4** is mounted on a pair of guides **4***d*, **4***d* for transverse movement in respect of the carriage (and the track), a hydraulic motor **4***a* being provided for effectuating such transverse movement in one or the other transverse direction.

For controlling track alignment in straight track sections, use is made of two parallel reference lines **5**, **5**. According to the invention, these reference lines are constituted by beams of radiation, the radiation consisting, for instance, of electromagnetic waves, such as light rays, infra-red rays, high-frequency waves or other energy. Each radiation beam emanates from an emitter **6** mounted on a bogie **8** arranged ahead of the frame **1** in the working direction of the apparatus. A receiver **7** for each beam of radiation is mounted at the rear of the frame

1 in the working direction of the apparatus. Each beam 5 is associated with a respective one of the rails 2 and the distance of the beams from each other is the same as that of the track rails. However, the ratio of the distances may have a predetermined value other than 1:1.

As shown in FIG. 2 at 9, a beam intensity meter is operably connected to each receiver 7. The beam intensity meter may be any suitable photoconductive detector used to detect and/or measure the emitted radiant energy by inducing a varying voltage in an electric circuit and may include a potentiometer, any of the commercially available instruments of this type being useful in the practice of this invention which is not concerned with the specific type of beam intensity detection. A signaling instrument may be operably connected to the beam intensity meter for indicating changes in the metered beam intensity, and such a signaling instrument may visibly show the indicated beam intensity changes in units of length on a suitably calibrated scale.

The signaling instrument illustrated by way of example in FIG. 5 includes a rotary recording instrument 9' which is driven synchronously by an odometer 9*b* which is attached to frame 1 and runs on the track rail to measure the distance of the machine as it moves along the track section during operation. The beam intensity, which is converted into a corresponding electrical signal by the beam intensity meter 9, is recorded on instrument 9' by a stylus 9*d* which is actuated by the electrical signal emanating from the beam intensity meter, the latter being electrically connected to the stylus, as shown. A measuring scale 9*c* indicates the beam intensity changes.

To enable the apparatus to be used for aligning track curves according to well known methods such as that disclosed in our Austrian Patent No. 227,749, for instance, the apparatus also includes aditional reference lines 10 and 11 which constitute chords within the track arc to be aligned. A shorter chord 10 extends from a front carriage 12 through the measuring point M to the track point R to be aligned. An associated longer chord 11 also extends from the carriage 12 through measuring point M but has about twice the length and ends at rear carriage 13 which follows the track alignment machine frame 1 in the direction of operation. Carriages 12 and 13 are coupled to the frame 1 by means of telescoping rods 14 or the like so that their distance from the frame may be selected according to local operating conditions.

The operation of the aligning system according to the present invention is shown, on an exaggerated scale, in FIG. 3 illustrating a track point which is out of alignment. As indicated in full lines, the stop 4 is not centered in respect to the longitudinal axis of the straight track at this point, thus leaving the one beam 5, shown at the top in FIG. 3, fully free to reach its receiver 7. The other beam, on the other hand, is completely covered, i.e. it is prevented from reaching its receiver. Thus, the upper signaling instrument 9 will show full beam intensity while the lower instrument will show no beam intensity at all. These signals may be used by an operator to move the track laterally in the upward direction, as seen in FIG. 3, i.e. to operate the track aligning means 3 until the stop 4, which moves in unison with the aligning means, has the position indicated in broken lines, at which point each rail is positioned at this point beneath an associated reference line 5. This position will be indicated by signaling instruments 9 by showing the same beam intensity on both instruments, at which moment the operator will terminate the operation of the track aligning means.

Obviously, the two signaling instruments could be replaced by a single instrument operably connected to both beam intensity meters for indicating any difference between the metered beam intensities. As long as there is such a difference, the operator would actuate the track aligning means. He would terminate the alignment operation when no beam intensity difference were shown on the signaling instrument. It will be equally obvious to those skilled in the art, that the signals could be used for automatically actuating the track alignment means and to terminate its operation when the beam intensities of both beams at their respective receivers are indicated as equal, i.e. if there is no difference between them.

To adapt the apparatus for use in track curves, the stop 4 must be mounted adjustably in respect of the track aligning means 3 so that it may be variably arranged in positions corresponding to the ordinate of the arc of the curve. The most economical manner of using the apparatus in track curves is that described hereinabove in connection with chords 10 and 11.

If only a single reference line is used with the apparatus of this invention, it is preferably positioned above one of the two track rails. At a track point which is out of lateral alignment with the remainder of the track (see FIG. 3), the stop 4 will then fully cover the reference line beam, partially cover it or permit it fully to pass to its receiver. As lateral misalignment decreases, the stop will gradually move out of the path of the reference line beam and the beam intensity will correspondingly increase to a maximum value which indicates the aligned position of the track. On the other hand, as lateral misalignment increases, the stop will move into the reference line beam path to decrease the beam intensity at the receiver. In either case, the changes in beam intensity at the receiver are indicative of the position of the track in respect of the reference line and may thus be used to align the track in respect of this line. Obviously, since the frame 1, on which the track alignment means and the stop are mounted, moves on and with the track, the position of the stop is always determined by the position of the track.

Various stops may be used. For instance, the portion of the stop in the range of the reference line beam path may be of varying transparency so that the beam will not be entirely interrupted when this stop portion is in its path but the semi-transparent stop portion will merely measurably change the beam intensity. With such stops, the measured changes in the beam intensity will indicate the position of the stop in respect of the beam even when the stop is in the path of the beam. These beam intensity changes and the deviation of the beam intensity from the maximum value indicative of the aligned track position may be used as a measurement of the track misalignment at each point and for aligning the track accordingly.

The preferred embodiment is that illustrated herein, wherein two reference line beams are used and wherein the stop extends transversely of the track and has the same width as the desired distance of the reference line beams from each other. In this case, the intensities of both reference line beams are simultaneously changed by the lateral movement of the stop. This makes it possible most precisely and simply to determine the position of the stop which corresponds to the alignment of the track at this point by comparing the beam intensities at their receivers.

While the receivers and beam intensity meters and associated signaling instruments have been shown mounted on the frame of a track aligning machine so that the operator of the machine may readily control the alignment, it is also within the scope of the present invention to mount the beam intensity meters on a track alignment measuring carriage, in which case a recording instrument may be operably connected to the beam intensity meter for indicating a measurable difference of the metered beam intensity from a control intensity value indicating the full beam intensity. Such a recording instrument may include an endless tape and a stylus to record the track alignment as a function of the measured reference line beam intensity. The tape may be calibrated to show the recorded differences in the metered intensity visibly in units of length. Obviously, where two beams are used, a single recording instrument may be used to indicate

measurable differences between the metered beam intensities.

While the present invention has been described and illustrated in accordance with certain preferred embodiments by way of example, many variations and modifications may occur to those skilled in the art, particularly after benefiting from the present teaching, without departing from the spirit and scope of this invention as defined by the appended claims. More particularly, a great variety of metering, signaling and/or recording instruments may be used and the resultant signals may be used in a variety of ways for controlling the operation of the track alignment. The same holds true for the type of stop used so that the stop may influence the beam intensity by minor as well as major movements of the stop in relation to the beam path.

We claim:

1. A mobile apparatus for the lateral alignment of a track rail point in respect of a reference system comprising two beams of radiation extending respectively vertically above a respective track rail, comprising

(1) two emitters of said beams mounted forwardly in the working direction of the mobile apparatus, each emitter being mounted vertically above a respective track rail,

(2) two receivers of said beams mounted rearwardly in the working direction of the mobile apparatus, each receiver being mounted vertically above a respective track rail,

(a) the beams of radiation having a measurable intensity,

(3) means for measuring the intensity of each beam,

(4) track alignment means at said track rail point, and

(5) a stop laterally movable in unison with the track alignment means at said track rail point,

(b) the stop being positioned between the beam emitters and receivers closer to the receivers,

(c) the stop being arranged to enter the path of a selected one of said beams, and

(d) the lateral position of the stop in respect of the selected beam of radiation measurably changing the intensity with which the selected beam is received at the receiver.

2. The mobile apparatus of claim 1, further comprising a carriage supporting the stop, and hydraulic means for holding the carriage against a selected one of the rails associated with the selected beam.

3. The mobile apparatus of claim 1, wherein the stop extends transversely of the track, the length of the stop being the same as the distance between the track rails.

4. The mobile apparatus of claim 1, further comprising a common frame carrying the stop, the track alignment means, and the beam receivers.

5. The mobile apparatus of claim 1, wherein the stop has vertically extending lateral edges.

6. The mobile apparatus of claim 1, wherein the beam intensity measuring means includes a beam intensity meter operably connected to each receiver.

7. The apparatus of claim 6, wherein said beam intensity meter is a potentiometer.

8. The apparatus of claim 6, further comprising a signaling instrument operably connected to each beam intensity meter for indicating changes in the metered beam intensity.

9. The apparatus of claim 8, wherein the signaling instrument visibly shows the indicated beam intensity changes in units of length.

10. The apparatus of claim 6, further comprising a recording instrument operably connected to each beam intensity meter for indicating a measurable difference of the metered intensity from a control intensity value indicating the full beam intensity.

11. The apparatus of claim 10, wherein the recording instrument visibly shows the recorded differences in the metered intensity in units of length.

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