Dec. 9, 1969 H. HELGEMEIR 3,482,527

SYSTEM AND METHOD OF STRAIGHTENING A RAILWAY TRACK

Filed Sept. 19, 1967 4 Sheets-Sheet 1

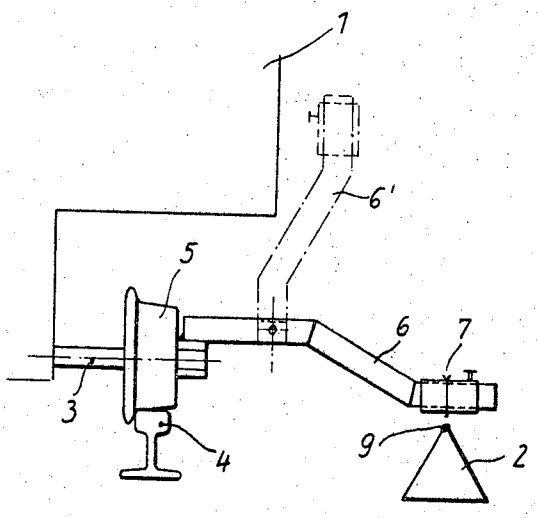


Fig. 1a

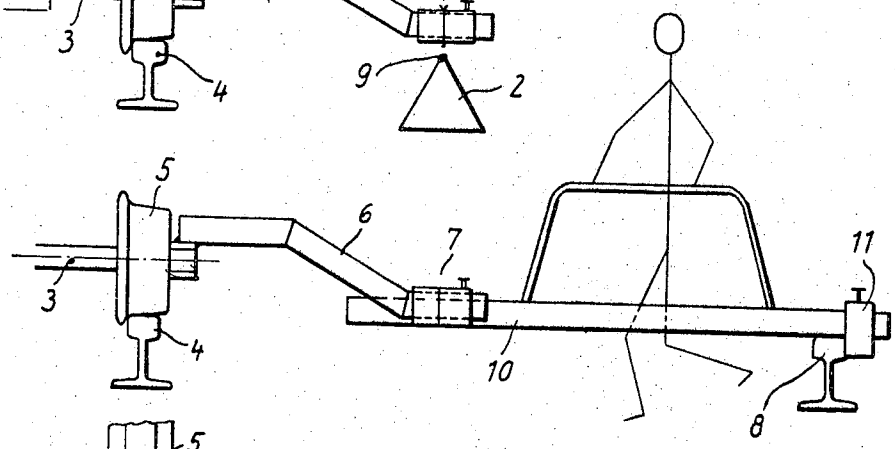


Fig. 1b

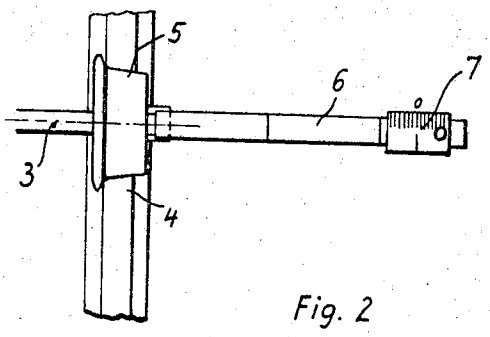


Fig. 2

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Dec. 9, 1969 H. HELGEMEIR 3,482,527

SYSTEM AND METHOD OF STRAIGHTENING A RAILWAY TRACK

Filed Sept. 19, 1967 4 Sheets-Sheet 2

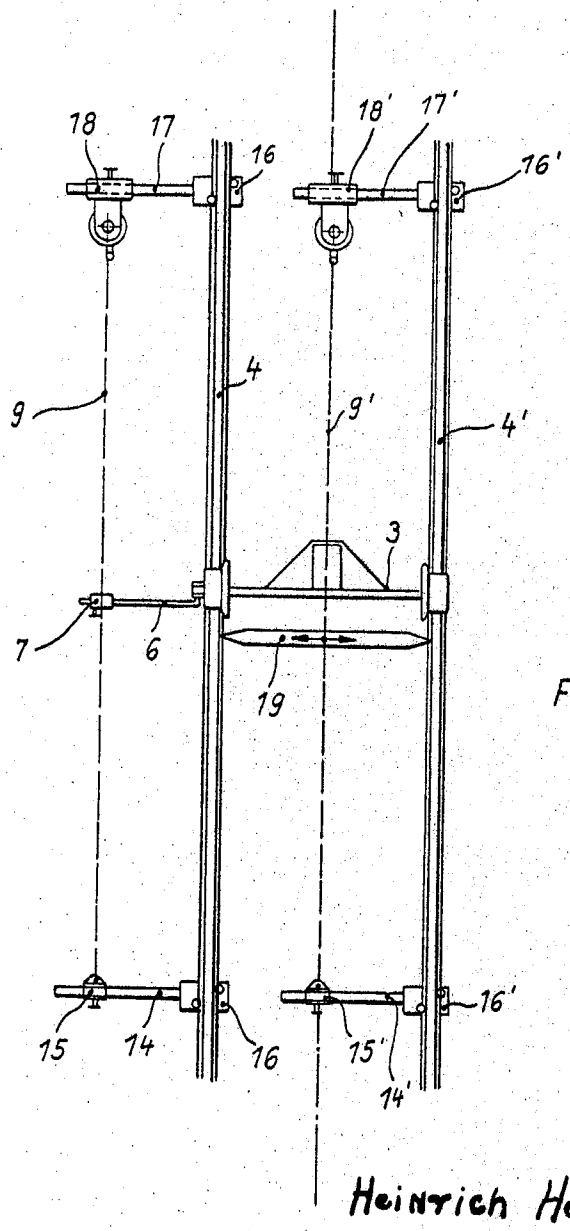


Fig. 1c

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SYSTEM AND METHOD OF STRAIGHTENING A RAILWAY TRACK

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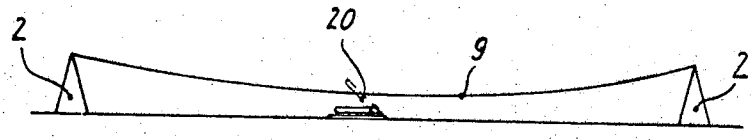


Fig. 3

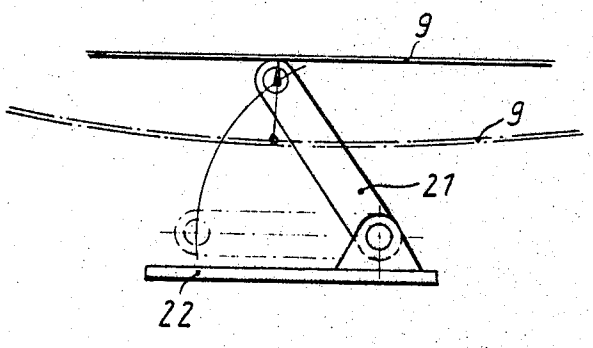


Fig. 4a

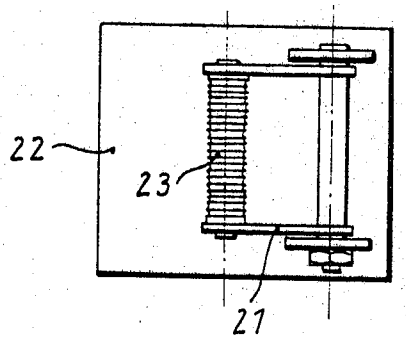


Fig. 4b

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Dec. 9, 1969 H. HELGEMEIR 3,482,527

SYSTEM AND METHOD OF STRAIGHTENING A RAILWAY TRACK

Filed Sept. 19, 1967 4 Sheets-Sheet 4

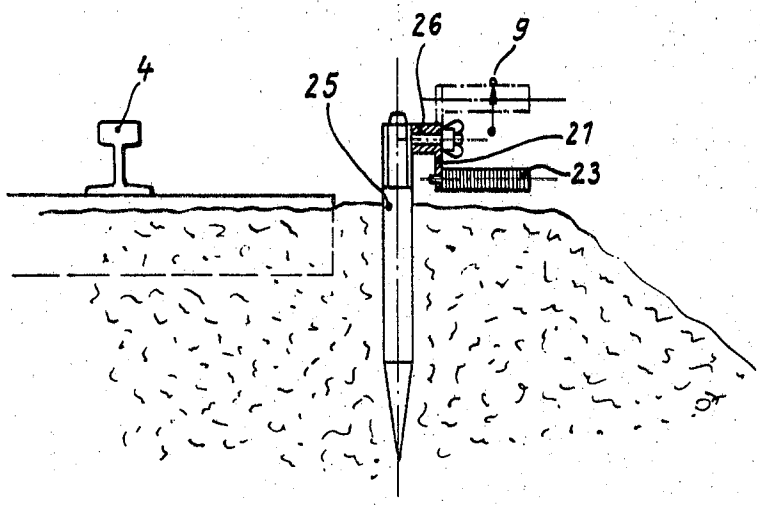


Fig. 5

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United States Patent Office 3,482,527
Patented Dec. 9, 1969

3,482,527

SYSTEM AND METHOD OF STRAIGHTENING A RAILWAY TRACK

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Filed Sept. 19, 1967, Ser. No. 668,846
Claims priority, application Germany, Mar. 3, 1967, R 45,428
Int. Cl. E01b *33/02*
U.S. Cl. 104—8 6 Claims

ABSTRACT OF THE DISCLOSURE

A method for horizontally straightening a track in accordance with fixed control points established by a survey to accurately determine track position in which use is made of a track straightening machine having hydraulic means for straightening the track in accordance with measured deviations, said method comprising the steps of establishing a reference line adjacent a track rail in accordance with fixed control points to define correct planar location of said rail, determining the desired offset distance from the established line to the correct rail position, continuously measuring the variation between desired offset distance and actually offset distance along the rail, and continuously repositioning the rail laterally in accordance with aforesaid measurements and system therefor.

The invention concerns a method for straightening a track in accordance with a stationary guide line, use being made of a track straightening or track constructing machine equipped with a straightening device.

Straightening machines are used to correct the position of the rails of a track insofar as the said position does not correspond to that of the line plan. The track straightening machines has for this purpose a hydraulic ram, for the displacement of the rail, i.e. of the track which is to be straightened. The said rams are known as straightening members. The track straightening machine has furthermore a measuring appliance for ascertaining to what extent a position of the rails corresponds to the theoretical position set out in the line plane.

In laying a track, a railway administration first has what is called a line plane drawn up, giving points in the terrain, comparatively widely spaced apart, for the track which is to be layed. The track has to run parallel to these points. An indication is also given in the line plane whether the track is to run straight or curved between these points, the said bend having a predetermined radius of curvature.

In order to lay a track according to the line plane, a surveyor fixes not only the said comparatively widely points in the landscape, but also establishes intermediate points, which are comparatively close together, consisting of steel stakes or the like. The said stakes are designated as control points, and carry a marking which forms the actual control point.

In accordance with an older proposal of the owner of the protection right, the straightening of the rails of a track in accordance with stationary control points is done by arranging an arm on the measuring axle which is held by a stop member on the rail to be straightened, said arm having a straightening mark at its end. When the arm is extended, the distance of the said mark from the rail to be straightened is equal to the theoretical distance of the line to be straightened from the mark point of a control point. A camera is arranged on a further arm, as viewing apparatus, and by observing its image it is possible to

ascertain whether the mark on the arm coincides with the mark point of the stake or rock used as control point. The straightening member of the track straightening machine are operated in accordance with the image produced by the camera until the measurement mark and the mark point coincide.

For the most part the control points are a quite considerable distance from each other, and the track is straightened accordingly.

It is the aim of the invention to carry out the described straightening process continuously in accordance with stationary points.

Accordingly in a method for straightening the track in accordance with stationary reference points, and making use of a track constructing machine, in particular a track straightening machine, which has hydraulically actuable straightening members for displacing the rail to be straightened, and a measurement axle which is held by a stop member on the rail to be straightened, for adjustment in relation to stationary points of reference, the invention has the feature that a guide line, for example a wire cord, is fixidly laid, on which a measurement mark provided on an arm of the measuring axle is set up. When one rail of a track has been correctly laid and straightened, this correctly laid rail can be used as guide line for the straightening process for the adjacent track.

Since in general an adjacent rail—or another guide line—will have varying distances from the rail to be straightened, it is advantageous for the length of the arm and also the camera to be variable and for adjustment marks to be provided for this purpose.

In a further embodiment of the invention a wire cord is clamped on the rail to be straightened by means of arms, and the measurement mark on the arm provided on the measurement axle is set up on the wire cord, it being ensured thereby that the rail runs parallel between the fixing points of the arms carrying the cord, fixed to the rail. In this connection it is possible for the cord to be clamped between the two rails of the track by means of the arms, with a mark on the measurement axle or on the straightening members themselves which can be observed from the drivers stand through a window provided in the bottom of the same, and can be set up on the cord.

A comparatively long cord clamped between two control points tends to sag, and if there is a wind the cord my swing out sideways so that it cannot from any accurate point of reference for the lateral displacement taking place in the horizontal plane, of the rail to be straightened. In order to exclude such inaccuracies, it is advantageous to arrange, underneath the cord at the measuring place, on a bearing plate or the like, an arm that can be swung up, carrying a cross-bolt of grooved or helicoidal construction, which arm, when as it swings the cord is located in a straight line, is swung up so that the cord can be fixed at this place by means of the grooved or helicoidal crossbolt. A pivotable arm of this type, provided with a crossbolt, can be fixed either to a transportable plate or to a fixing stake driven into the ground.

The invention will now be described with reference to the accompanying drawings, which show embodiments of the invention but in no restrictive sense.

FIGURES 1*a* to 1*c* show arrangements for carrying out the method of the invention.

FIGURE 1*a* shows a reference wire cord clamped between two control point stakes.

FIGURE 1*b* shows an already corrected rail, in position.

FIGURE 1*c* shows a cord clamped to a rail as reference guide line.

FIGURE 2 shows the arrangement of the adjustable measurement mark on the arm of the measurement axle.

FIGURE 3 is a representation of the way a clamped cord sags.

FIGURES 4*a* and 4*b* show a fixing device which has the purpose of fixing the sagging cord in the angle of sighting, even if there is a wind.

FIGURE 5 shows a device similar to the arrangement shown in FIGURES 4*a* and 4*b*.

It should be noted that by stationary reference points or a fixedly laid guide line or guide wire, a wire cord is to be understood which is not fixed to the chassis of the track constructing machine itself; the cord does not need to be permanently arranged on site, but can be set up as needed.

In FIGURE 1*a*, the chassis of the track straightening machine is shown at **1**, whose measurement axle **3** is displaced axially in the way known per se so that the rim of the wheel **5** positioned on the measurement axle **3** rests on the side plate of the rail **4** to be straightened. An arm **6** is arranged on the said measurement axle **3**, which when the track straightening machine is to travel from one spot to another, is folded back into the vertical position **6'** lying in the side plate profile. At **2**, a control point stake can be seen. The wire cord **9** is clamped between two adjacent control points **2**. At the front end of the arm **6** there is a measurement mark; advantageously, the measurement mark is adjustable at the end of the arm **6**, so that the distance of the measurement mark from the rim of the wheel **5** and the rail **4** to be straightened can be adjusted.

In the embodiment in accordance with FIGURE 1*a*, the measurement mark **7** of the arm is made to coincide with the clamped cord by direct observation, the straightening members displacing the rail **4** until coincidence of the measurement mark **7** and the cord **9** is obtained. It is then ensured that the rail **4** has the correct distance from the cord **9** and the control point stakes **2** carry it. In accordance with FIGURE 1*b* the right-hand rail **8** of the adjacent track is used as reference line, a measurement plate **10** being arranged on the side plate of the rail **8** in the transverse direction. The said measurement plate **10** also carries a reference mark, to which the mark **7** of the arm is adjusted. The measurement plate **10** is arranged on the rail **8** by means of an adjustable stop member **11**. In this embodiment, the rail **8** of the adjacent track is used as reference line.

In accordance with FIGURE 1*c* the clamps **16** are fixed to the rail **4** to be straightened. The clamps **16** carry arms **14, 17** on which the ends of the cord **9** are fixed in such a way that the cord runs parallel to the control points. The rail **4** to be straightened is then displaced by the straightening members **19** until at the displacement place the rail **4** runs parallel to the cord **9**, this being ascertained by the measurement mark **7** of the arm **6** of the measurement axle **3**.

The cord **9'** between the rails of the track can also be fixed by means of clamps **16'** and arms **14', 17'**. In this case a mark provided on the measurement axle **3** or on the straightening members **19** can be observed directly from the drivers stand through a window located in the bottom of the said stand, and adjustment can be made accordingly. In this arrangement also, the fixing points **15', 18'** of the cord in relation to its distance from the rail **4** are adjustable parallel to the control points. The cord is kept clamped by means of an arrangement of the springs shown diagrammatically at the fixing place **18, 18'**.

As FIGURE 3 shows, a cord **9** clamped between two comparatively widely spaced control points **2** tends to sag. When there is a wind, the cord swings, and the setting up of the measurement mark **7** of the measurement axle **3** or its arm **6** is made difficult and inaccurate. The invention accordingly provides a trestle-type part **20** underneath the cord **9**, which carries a grooved or helicoidal

crossbolt **23** in such a way that it can be swung up; the base plate is seen at **22** and at **21** one of the two arms which can be swung up. The arm **21**, when the cord is sagging, is swung up, and thereby the cord is fixed at this place horizontally.

In accordance with FIGURE 5 the grooved crossbolt **23** is fixed by means of an eccentric arm **26** to a stake **25** driven into tthe ground. In this case also, the cord is fixed horizontally by the swinging up of the eccentric arm **21, 26,**

Instead of visual observance of the coincidence of the measurement mark with the stationary guide line, there can also be an arrangement wtih a television camera on the chassis of the track straightening machine, which is used as sighting device for the coincidence of the measurement mark with the stationary guide line, as described in the older application R 43,266. Such a camera provided on the chassis of the straightening machine makes it possible to carry out the straightening process directly from the drivers stand. The use of a television camera with track constructing and straightening machines is described in detail in DBGM 1,936,945.

What we claim is:

1. A method for horizontally straightening a track in accordance with fixed control points established by a survey to accurately determine track position in which use is made of a track straightening machine having hydraulic means for straightening the track in accordance with measured deviations, said method comprising the steps of:

(1) establishing a reference line adjacent a track rail in accordance with fixed control points to define correct planar location of said rail,

(2) determining the desired offset distance from the established line to the correct rail position,

(3) continuously measuring the variation between desired offset distance and actually offset distance along the rail, and

(4) continuously repositioning the rail laterally in accordance with aforesaid measurements.

2. The method as set forth in claim **1** and wherein step (1) comprises the positioning of a wire line along succesive points adjacent a rail in accordance with fixed control points and supporting said line by the rail being straightened.

3. The method of claim **2** and including the supporting of the wire line intermediate the successive points to prevent sag and sway.

4. A system for straightening a track in accordance with fixed control points established by a survey to accurately determine track position, said system comprising

(1) a pair of rails defining a track,

(2) a line positioned adjacent one rail in accordance with fixed control points and at a predetermined offset distance from the desired rail alignment,

(3) a track straightening machine movably mounted on the track,

(4) hydraulic rail straightening means carried by said track straightening machine,

(5) a measurement axle carried by the track straightening machine,

(6) a wheel mounted on said axle and riding on the rail to be straightened,

(7) a measuring arm extending outwardly from the axle toward and beyond the line, and

(8) a measurement marker carried by said arm and having an index point defining the desired offset distance from the line to correct rail position whereby variations in rail alignment will be readily measurable by comparing position of index point to the line and the rail straightened accordingly.

5. The invention as set forth in claim **4** and wherein means are provided to prevent the line from sagging or swaying.

6. The invention as set forth in claim 4 and wherein the measuring arm is pivotable adjacent the axle so that the arm may be swung upwardly away from the line.

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