Dec. 30, 1969 F. PLASSER ET AL 3,486,461

METHOD AND APPARATUS FOR ALIGNING TRACK

Filed Jan. 29, 1968 3 Sheets-Sheet 1

Fig. 1

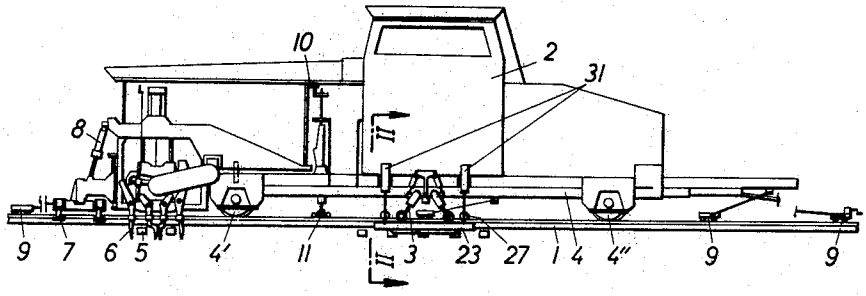
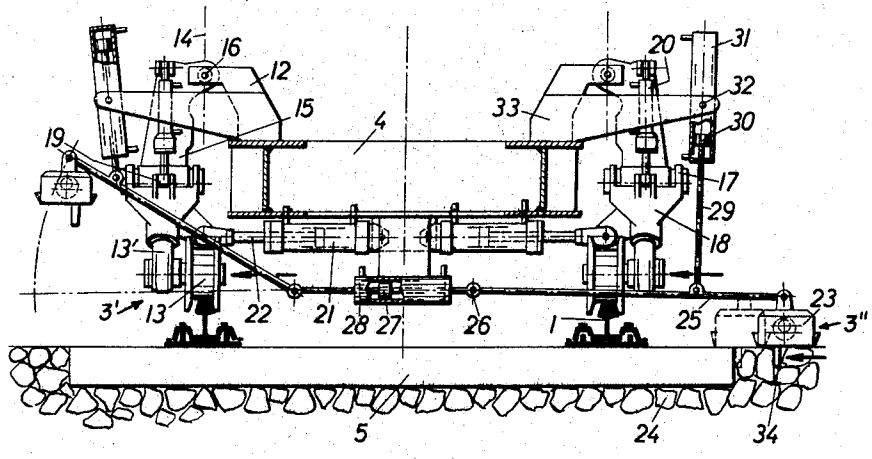


Fig. 2



METHOD AND APPARATUS FOR ALIGNING TRACK

Filed Jan. 29, 1968 3 Sheets-Sheet 2

Fig. 3

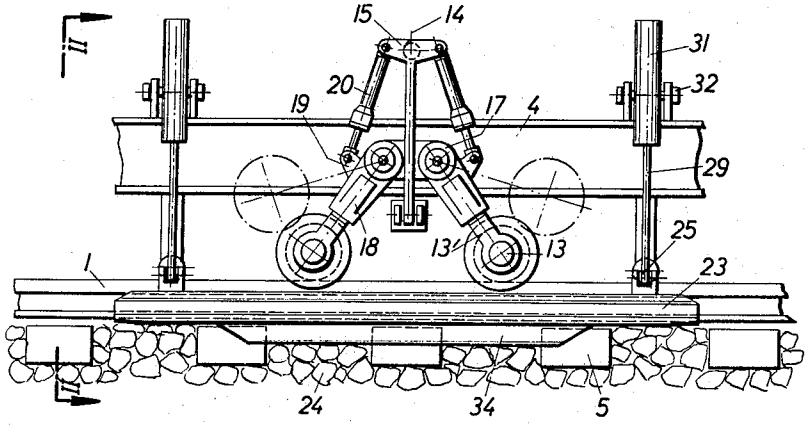
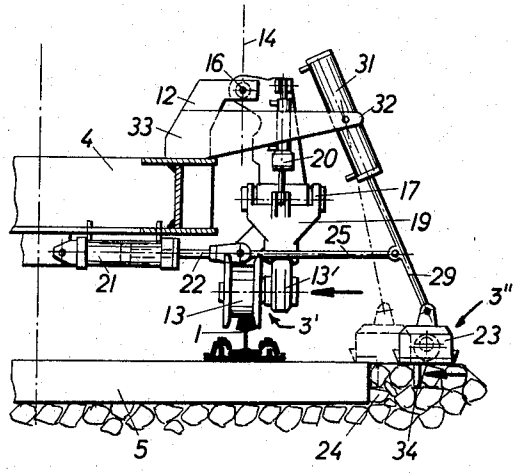


Fig. 4

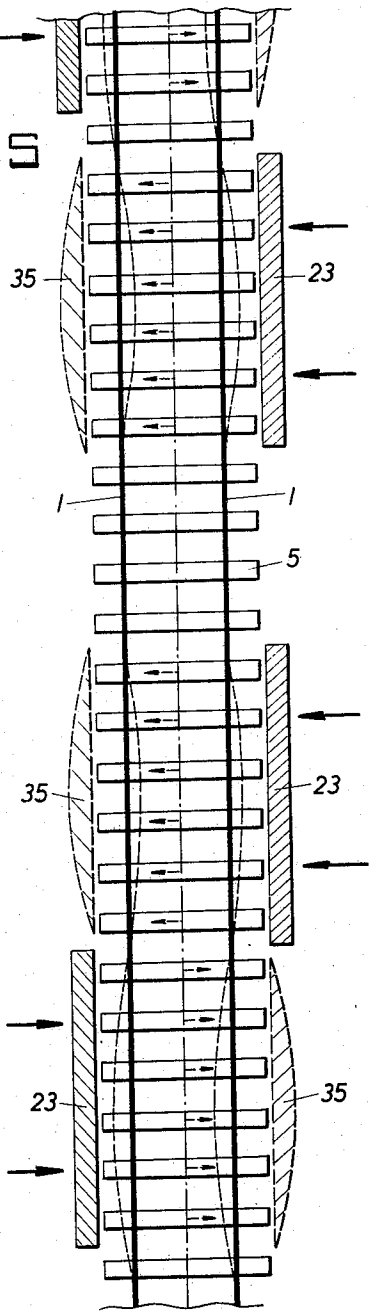


Dec. 30, 1969 F. PLASSER ET AL 3,486,461

METHOD AND APPARATUS FOR ALIGNING TRACK

Filed Jan. 29, 1968 3 Sheets-Sheet 3

Fig. 5



United States Patent Office 3,486,461 Patented Dec. 30, 1969

3,486,461

METHOD AND APPARATUS FOR ALIGNING TRACK

Franz Plasser and Josef Theurer, both of Johannesgasse 3, Vienna, Austria

Filed Jan. 29, 1968, Ser. No. 701,250
Claims priority, application Austria, Feb. 6, 1967, A 1,128/67
Int. Cl. E01b 33/00
U.S. Cl. 104—8 19 Claims

ABSTRACT OF THE DISCLOSURE

An improved method and apparatus for the lateral alignment of track, wherein the forces necessary for the lateral displacement of the track are exerted both on the rails and on the ties embedded in the ballast; the force acting on the tie heads is applied either directly to the tie end face or indirectly through the ballast in front of the tie. In order to locate the track in the corrected position and to prevent the partial springing back into the faulty position, the ballast is tamped by surface compaction during the displacement on the side from which the track is moved. An additional, downwardly directed force is applied to the aligning tools in order to prevent undesirable level distortion of the track during the alignment.

The invention relates, as indicated, to track aligning apparatus for correcting straight or curved track sections.

Known apparatus for aligning track are equipped with aligning tools which act on one or both rails of the track in order to shift the same together with their ties within the ballast. This displacement is effected from the position of the track into a corrected position, determined by measuring results, calculations or plans. Since the aligning tools of the known track aligning machines act on the track, whilst the resistance caused by the ballast is active mainly on the end faces of the tie, these two forces form a couple tending to tilt the ties, and thus also tending to change the level of the rails in an undesirable manner. In addition, since the transverse aligning forces must also be transmitted to the ties via the fixing means for the rails to the ties, these are highly stressed, and may even be damaged, if the aligning forces applied thereto are great.

In addition thereto, a phenomenon has frequently been observed which is usually referred to as "springing back." During this process, the laterally shifted track moves back towards its original position by a certain amount. In order to compensate for this return movement, the track must be shifted by applying correspondingly greater forces by a larger amount than that corresponding to the actual difference between the real and corrected positions. This so-called over-alignment is both time wasting and requires highly trained operators.

There have already been proposed track straightening or aligning machines which lift the track during its lateral alignment. However, these require the subsequent leveling and are therefore disadvantageous. Furthermore, there are also known aligning machines equipped with aligning tools which dip into the ballast in the region of the tie heads and transmit the necessary effort indirectly through the ballast to the sleeper. Also these machines are not satisfactory from the viewpoint of operation and accuracy.

The main object of the present invention is a method and apparatus for aligning track, wherein the springing back of the track is avoided so that over-alignment is no longer necessary.

It is a further object of the invention to provide a method and apparatus for aligning railroad track without interfering with its level in an undesirable manner.

It is yet another object of the invention to provide a method and apparatus for aligning track, whereby the transmission of the aligning forces to the ties is so improved that excess stresses of the fixing means between rails and ties cannot occur.

It is a further object of the invention to provide a method and an apparatus for aligning track, whereby the track is better retained after the alignment from its prior position.

Further objects and advantages of the invention will become apparent from the following description in conjunction with the accompanying drawings and the appended claims. In the drawings:

FIG. 1 is a side elevation of a complete track aligning machine comprising an apparatus according to the invention for aligning the track;

FIG. 2 is a view of the apparatus according to the invention, viewed in the longitudinal direction of the track;

FIG. 3 is an enlarged detailed view of the apparatus of FIG. 1;

FIG. 4 is a modified embodiment of the apparatus accord to the invention; and

FIG. 5 is a diagrammatical top view explanatory of the functioning of the apparatus according to the invention for the lateral alignment of track.

A track aligning machine, shown generally at **2**, and equipped with an apparatus according to the invention, is adapted to travel on the rails **1** of a track. The machine is a leveling-straightening-tamping machine. The straightening tool unit is shown generally at **3**. It is located substantially in the longitudinal center of the chassis **4** of the machine **2**, which chassis is mounted on bogies **4'** and **4''**. The track aligning machine **2** has in its front part (on the left in FIG. 1) tamping tools **6**, serving to tamp the ties **5** after these have been moved to the correct level. Furthermore, the machine **2** has roller grips **7** for lifting the track, one pair of these rollers being associated with each rail and adapted to be lifted by a lifting mechanism **8**. Small trolleys **9** serve for mounting and anchoring reference lines, serving as basis for monitoring the lateral alignment of the track and represented, for example, by wires. Similarly, the raising of the track is also monitored by reference lines, the rearward end **10** of which is located within the track aligning machine **2** and extending to a leading trolley, located in the as yet uncorrected track zone. The rear end of this reference line, which may also be a wire, is mounted independently movable relative to the rails **1** at **11**. These details do not form part of the invention and will not be described in detail in the following description. Reference is made, by way of example, to our prior Patents Nos. 3,192,870, 3, 211,109 and 3,314,373.

As shown in FIG. 2, the chassis **4** of the aligning machine **2** has brackets **12** serving to mount laterally movable straightening or aligning tools **3'** acting on the rails **1**. These aligning tools **3'** comprise each substantially a support arm **15**, connected via a ball joint **16** pivotably with one of the brackets **12**, rigidly mounted on the chassis **4**, two holders **18**, extending slopingly downwardly towards the front and rear respectively, connected through joints **17** with the support arm **15**, and wheels **13**, received in the holders **18** by shafts **13'** and rotatably mounted in the said shafts **13'**. The joints **17**, which connect the holders **18** to the support arm **15**, permit a pivotal movement of the holders in a vertical plane parallel to the track axis. On the leading and trailing sides, respectively, of the holders **18**, there are fixing lugs **19** as hinge points for hydraulic units **20**. The upper ends of these piston-cylinder units **20** are hinged to lugs **15'** of the support arm **15**, projecting towards both sides.

The wheels **13** roll along the rail heads of the associated rails **1**. They have flanges **13***a* which overlie the rail

head flanks on both sides and have such profiles that they rest flush on the rail head flanks and can transmit forces acting on the rails **13** (in the direction of the plane of FIG. 2) to the associated rail. The radial width of the wheel flanges **13***a* is such that they can make contact with the rail head flanks over their whole height or almost over their whole height. This ensures not only a uniform transmission of the force, but produced, in view of the usually upwardly tapering rail head flanks, a downwardly directed component of the horizontal force which has a beneficial effect on the quality of the alignment, as will be explained further below. The wheels **13** are mounted exchangeably in the holders **18** by means of the said shafts **13'** so as to enable different wheels to be fitted in accordance with the rail profile. The width of the wheels **13** is such that, when one wheel flange **13***a* rests on the rail, the other is spaced therefrom with a certain clearance. The exchangeable mounting of the shafts **13'** in the holders **18** is indicated by dotted lines. The shafts **13'** may be secured in the holders **18** by means well known in the art, for example, by screws.

On the underside of the chassis **4**, there are mounted on a downwardly projecting lug, hydraulic units **21, 22**, associated with each aligning units **3'** acting on the rail. As may be seen from FIG. 2, the hydraulic units **21, 22** are substantially horizontal; the facing inner ends of the cylinders **21** are hinged to the chassis **4** and the outwardly pointing ends of the pistons **22** are each connected with one support arm **15**. The hydraulic units **21, 22** communicate via conduits **21'** with a pressure medium source, not shown, and located inside the track aligning machine **2**, e.g., a hydraulic pump, and are supplied with pressure medium thereby. Similarly, the hydraulic units **20** communicates through conduits **20'** with the same or with another pressure medium source within the track aligning machine **2**. Obviously, the supply of pressure medium may be controlled by means of suitable valves, not shown in the drawing.

On both sides of the chassis **4**, there are lateral aligning tools, shown generally at **3''**, which do not act on the rails, as do the aligning tools **3**, but are placed outside the heads of the ties **5** on the ballast **24**. These aligning tools **3''** comprise substantially each a pair of laterally projecting support arms **25**, located under the chassis **4** and hinged to the piston-cylinder units **27, 28**; substantially vertical hydraulic units **30, 31** whose piston rods are articulated at a certain distance from the outer ends of the support arms **25**; and a surface tamper **23** hinged always to the outer end of the support arm **25**. The surface tampers **23** extend, as shown in FIG. 3, substantially parallel to the rails **1** outside the ties and have a length amounting to a multiple of the spacing between the ties. The hydraulic units **28, 27** and **30, 31** act on the surface tampers **23** in the vicinity of their leading and trailing ends.

The underside of each surface tamper **23** is equipped with a downwardly projecting member **34** in the shape of a longitudinal rib which penetrates into the ballast **24**. The substantially vertical hydraulic units **30, 31** are mounted on arms **33**, rigidly connected with the chassis **4**, and are pivotable in a vertical plane perpendicularly to the track axis.

FIG. 4 shows a modification of the apparatus shown in FIG. 2, differing in that the laterally adjustable aligning tools **3''** acting on the end faces of the ties **5**, and the aligning tools **3'** acting on the rails **1**, have a common drive. The support arms **25** are here hinged by their inner ends to the outer ends of the pistons **22** of the piston-cylinder units **21, 22** and are actuated thereby.

The operation of the apparatus is as follows:

In the inoperative position, the wheels **13** are located in the holders **18** under the action of the hydraulic units **20** in an upwardly pivoted rest position and out of engagement with the rails **1**, as shown by dotted lines in FIG. 3. Also the tampers are raised and out of engagement with the ballast. If the apparatus is to be operated, the pistons in the hydraulic units **20** and **30, 31** are actuated by the pressure medium, causing the wheels **13** to be lowered onto the rails **1** and one of the tampers **23** on the side, from which the track is to be removed, onto the ballast **24**. The rib-like projection **24** of the tamper **23** enters into the ballast. As indicated by dotted lines in FIG. 4, the rib-like projection may rest either directly on the end face of the tie or be spaced therefrom by a certain amount.

Inside the tampers **23** there are, as indicated by dotted lines in FIG. 4, for example vibrators, such as eccentric vibrators, supplied either by a conduit, not shown from a source of energy mounted inside the machine **2**, or else by energy sources, e.g., electrical batteries, mounted within the tampers **23** themselves.

When the track aligning machine **2** reaches a position of the track, in which the actual position differs from the correct position, the track is shifted, e.g., to the left in FIG. 2, by the force generated by the hydraulic units **21, 22** and by the force transmitted by the hydraulic units **27, 28** to the surface tampers **23**. The force acting on the tie heads via the tampers **23**, is transmitted either directly, if the rib-like member rests directly on the tie end face, or indirectly through the ballast thereinbetween, if the tamper **23** is in the position shown by solid lines in FIG. 4. The force applied by the hydraulic units **27, 28** acts on the aligning tools acting on the rails **1**.

Due to the division of the lateral aligning force between the aligning tools **3'** and **3''**, the stress affecting the rail fixing means is substantially reduced. Here it is of special advantage if, as shown in FIG. 2, the aligning force affecting the rails is applied by means of a corresponding arrangement of opposite aligning tools **3'**. In this case, the amount of the displacement can be controlled particularly accurately, because the action of the aligning tools **3'** is effectively supported by the aligning tools **3''** acting on the ties. According to the magnitude of the required lateral force, the forces may be so divided that the aligning tools **3''** acting on the tie heads exert a stronger effort than those acting on the rails **3'**. This may be controlled by way of the associated hydraulic units **27, 28**.

Since a substantial part of the aligning force to be applied is directly in the line of action of the resistance acting on the tie heads, the tilting moment tending to tilt the ties is also much smaller. This is further supported by the fact that the hydraulic units **20** acting on the rails, i.e., on the tools co-operating with the rails, exert a downwardly directed force. Thus, the level of the rails remains unaltered during the whole lateral aligning operation.

A particularly secure position and fixing of the track in the correct position is achieved if the aligning tools **3''** acting on the tie heads are used as shown, as surface tampers **23**. The resulting effect is now explained with reference to FIG. 5. The plane of oscillation of the eccentric vibrators arranged in the tampers **23** is perpendicular to the longitudinal axis of the rail. Conveniently, the vibrations produced by the vibrators have an oscillation resultant directed perpendicularly to the rail axis. In order to correct the faulty rail position, shown by dotted lines in FIG. 5, the surface tampers **23** used in conjunction with the aligning tools **3'** acting on the rails **1** are used only on that side of the track, from which the rail is to be laterally displaced. The action of the vibrators produces at these points compacted zones of ballasting which effectively prevent the jumping back of the track into the original faulty position, which may be due to various causes. The displacement of the ties produces also compacted zones on the other side of the track, indicated by circular segments **35**; these form under the action of the moving sleeper heads and contribute substantially to the fixing of the track. An essential feature of the method according to the invention is that, as indicated in FIG. 5, the ballast is compacted always only at that side from

which the track is to be moved. The compaction should be effected at least partly simultaneously with the movement of the track, i.e., the compaction should be started at the latest during the transverse movement. During this, the surface tampers **23** shift with their rib-like projections **34** at least a part of the ballasting **24** into the zone to be compacted and located in front of the tie heads, perpendicularly to the longitudinal axis of the track. Also this is a substantial feature of the present invention.

Naturally, the invention may be modified in many ways, without thereby departing from its principle.

Having thus fully disclosed our invention, what we claim and desired to secure by Letters Patent is:

1. In a track aligning machine with a chassis mounted on bogies and adapted to travel on rail track, mounted on ties in ballasting, an improved apparatus for the lateral alignment of the track by means of a reference system, wherein the improvement comprises aligning tools acting on at least one rail of the track and movable transversely of the track and of the said chassis, at least two aligning tools acting on the heads of the said ties and movable transversely of the track and of the chassis, and arranged on opposite longitudinal sides of the said chassis, and means for simultaneously applying forces, directed transversely of the track and to the said aligning tools to shift the track from its real into its corrected position as determined by said reference system.

2. An apparatus as set forth in claim **1**, wherein the said aligning tools acting on at least one rail of the track, and the said aligning tools acting on the tie heads, have a common device for applying a force directed transversely of the track.

3. An apparatus as set forth in claim **1**, wherein the said means for simultaneously applying forces to the aligning tools directed transversely of the track is connected to a common source of pressure medium.

4. An apparatus as set forth in claim **1**, wherein the said aligning tools are arranged within the same cross-sectional region of the chassis.

5. An apparatus as set forth in claim **1**, wherein the oppositely mounted aligning tools acting on the tie heads, have a common device for applying forces transversely of the track.

6. An apparatus as set forth in claim **1**, wherein the aligning tools acting on the tie heads have a length amounting to a multiple of the spacing between the ties, and are provided with downwardly extending rib-like projections which penetrate into the ballast substantially parallel to the longitudinal axis of the track and transmit transversely directed forces to the tie heads.

7. An apparatus as set forth in claim **1** further including means for compacting the ballast in front of the tie heads.

8. An apparatus as set forth in claim **7**, wherein the aligning tools acting on the tie heads are themselves constructed as devices for tamping the ballast.

9. An apparatus as set forth in claim **7**, wherein the devices for tamping the ballast are surface tampers with vibrators.

10. An apparatus as set forth in claim **7**, wherein the aligning tools acting on the rails comprise wheels with bilateral flanges, which are adapted to the profile of the rail heads, holders for receiving the said wheels, a support arm hinged to the chassis of the aligning machine and to which the said holders are articulately fixed, wherein the said devices for applying a transversely directed force act on the said support arm and displace the same in a vertical plane perpendicularly to the track axis.

11. An apparatus as set forth in claim **10** wherein the said support arm supports at least two holders and two wheels are mounted in longitudinally spaced relationship exchangeably in the holders.

12. An apparatus as set forth in claim **1** further including means for applying downwardly directed forces to the aligning tools acting on the track and the aligning tools acting on the tie heads.

13. An apparatus as set forth in claim **12**, wherein the means for applying the downwardly directed forces to the said aligning tools are hydraulic cylinder-piston units, and whereby the aligning tools can be swivelled upwardly into an inoperative position.

14. An apparatus as set forth in claim **13**, wherein the said hydraulic cylinder-piston units acting on the aligning tools affecting the rails, act on the one hand on the support for the aligning tools and on the other hand on the holders for the aligning tools, wherein the holders are connected with the support so that they are pivotable in a vertical plane parallel to the longitudinal axis of the track.

15. An apparatus as set forth in claim **1**, wherein the aligning tools acting on the ties have a length of a multiple of the spacing between ties and the hydraulic cylinder-piston units apply downwardly directed force acting on the leading and trailing ends of the said aligning tools.

16. An apparatus as set forth in claim **1**, wherein the aligning tools acting on the tie heads transmit transversely directed forces indirectly through the ballast between the heads and the tools.

17. An apparatus as set forth in claim **8**, wherein the aligning tools acting on the tie heads and constructed as means for tamping the ballast transmit transversely directed forces indirectly through the ballast between the tie heads and the aligning tools.

18. A method for the lateral alignment of tracks, comprising the following steps, namely the application of a transversely directed force to at least one rail of a track mounted with its ties in ballasting; the application of a further transversely directed force acting on the heads of the ties on the side from which the track is to be moved; and the shifting of the track under the simultaneous application of both transversely directed forces from its real into its corrected position.

19. A method for the lateral alignment of tracks, comprising the following steps, namely the application of a transversely directed force to at least one rail of a track mounted with its ties in ballasting; the application of a further transversely directed force acting on the heads of the ties on the side from which the track is to be moved; the shifting of the track under the simultaneous application of both transversely directed forces from its real into its corrected position; and the tamping or compacting of the ballast during the said lateral shifting in the zone in front of the tie heads on that side of the track from which the track is to be moved.

References Cited

UNITED STATES PATENTS

2,693,769	11/1954	Herlehy	104—8
2,869,476	1/1959	Kershaw	104—12
2,926,616	3/1960	Talboys	104—8
3,196,803	7/1965	Plasser et al.	104—8

ARTHUR L. LA POINT, Primary Examiner

RICHARD A. BERTSCH, Assistant Examiner

U.S. Cl. X.R.

104—7