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[54] **MOBILE TRACK TAMPER FOR CONTINUOUSLY CORRECTING A TRACK POSITION**

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[51] **Int. Cl.** **E01b 27/17**

[58] **Field of Search** ..... 104/1, 7 R, 78, 8, 12, 7

[56] **References Cited**

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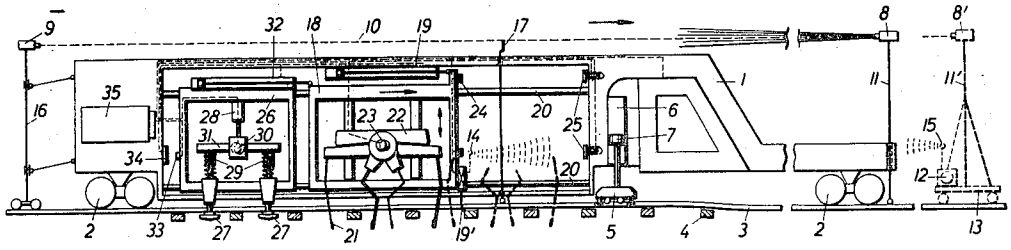
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[57] **ABSTRACT**

In track leveling and/or lining with a continuously advancing track tamper, the tamping tools are continuously moved relative to the continuously advancing machine frame in synchronization with the machine advance in such a manner that the tamping tools are held in respective cribs while they tamp the ballast.

41 Claims, 6 Drawing Figures



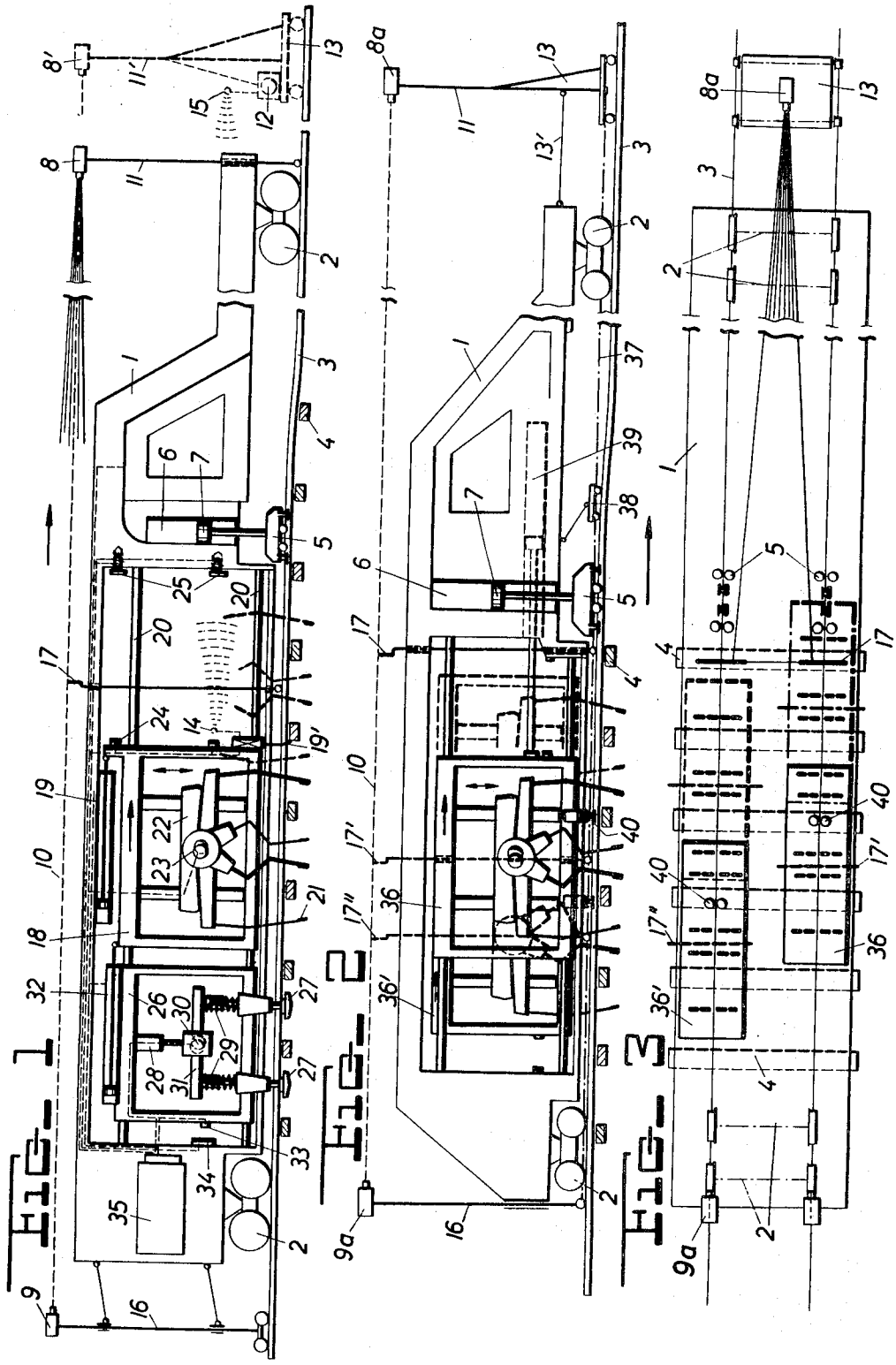
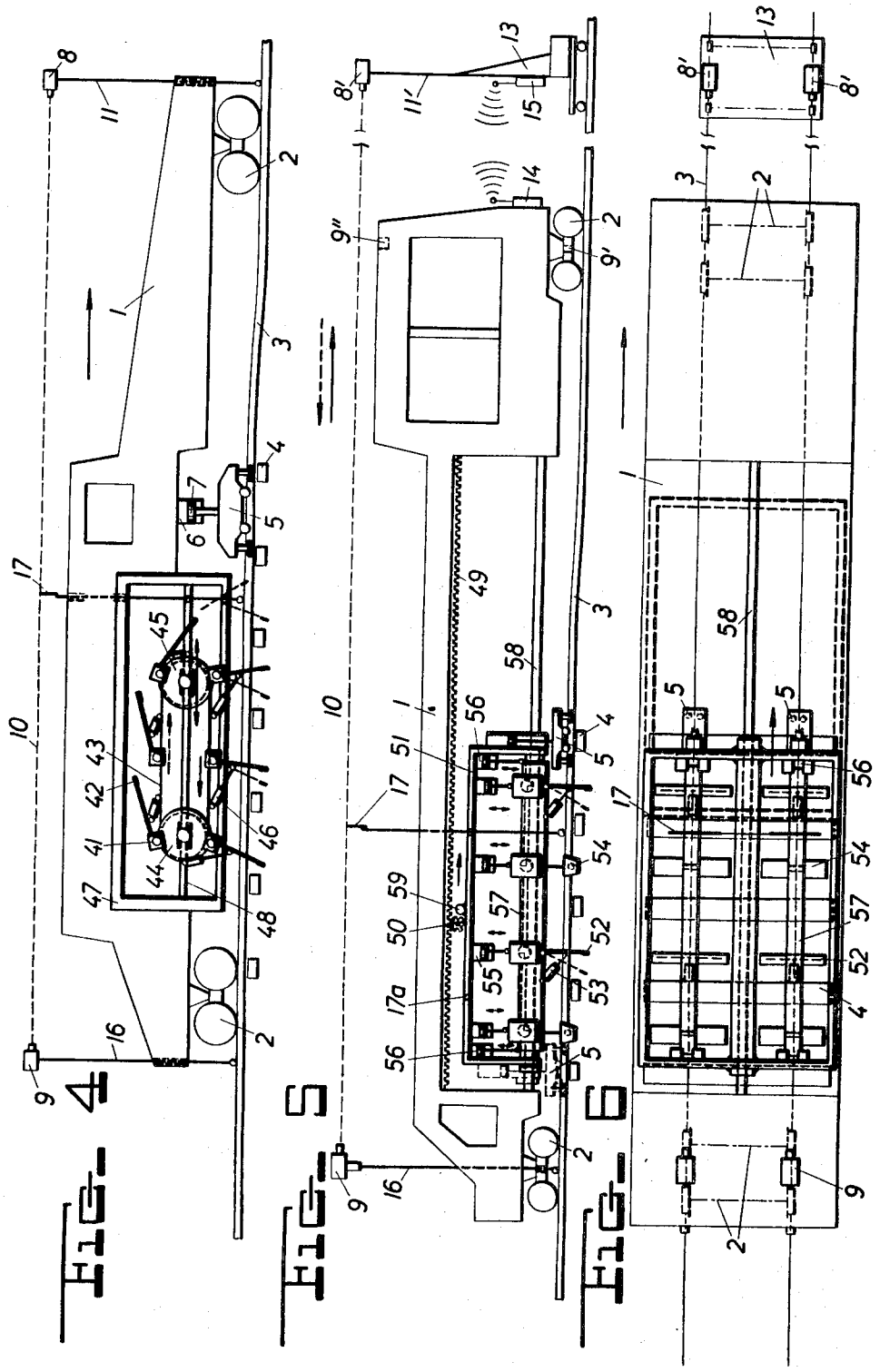


FIG. 1

FIG. 2

FIG. 3


FIG. 4
FIG. 5
FIG. 6

MOBILE TRACK TAMPER FOR CONTINUOUSLY CORRECTING A TRACK POSITION

This is a division of application Ser. No. 48,127, filed June 22, 1970, now U.S. Pat. No. 3,687,081.

The present invention relates to improvements in a mobile track tamping machine for correcting the position of a track in relation to a reference system. The tamping machine comprises a frame, a track moving unit for raising and/or laterally shifting the track, which unit is mounted on the machine frame, and a plurality of ballast tamping tools mounted on the frame for tamping the ballast in the crib between the track ties.

Conventionally, track leveling and/or lining, combined with track tamping designed to fix the track in the corrected position, has usually been effectuated with mobile machines advancing intermittently in a working direction along the track. During the intermittent stops of the machine, the tamping tools were immersed in successive cribs to compact the ballast in the cribs or underneath the adjacent ties, the machine being stopped as long as the tamping proceeded. This, of course, involved time losses whose length depended primarily on the extent of tamping effectuated.

Aside from the cumulative time loss during the track corrrcting operation, this procedure also involved relatively rapidly repeating braking of the very heavy tamper and similarly rapidly repeating setting in motion of the heavy tamper as the same is advanced from tie to tie. The difficulties are compounded by the necessity of stopping and moving at rather precise intervals so as to center the tamping tools properly in the cribs, and to keep the forward end of the reference system at a proper distance. While attempts have been made to overcome at least some of these difficulties by automated controls, they have not always been successful because of the irregularities in the structure of most tracks.

It is a primary object of this invention to overcome the above and other disadvantages in track leveling and/or lining operations so that the same may proceed truly continuously and without any interruptions while obtaining very accurate track positioning and fixing the track in the corrected position.

By avoiding the intermittent stops along the entire track section to be corrected and advancing smoothly and continuously along the track while the various required tools effectuate the desired work, such as raising, lining and tamping, the track position can be corrected very precisely and the quality of the tamping may be kept at the highest level to assure long lasting fixation of the track in the corrected position. In other words, the tamping time need not be shortened to save time but it may be controlled so as to obtain the necessary tamping under all track conditions without the need for stopping the operation.

The above and other objects and advantages of the invention are accomplished by continuously advancing a mobile tamping machine of the above described type along the track in a working direction while maintaining the track moving unit in continuous gripping engagement with the track rails while the machine continuously advances and the track is thus raised and/or lined in relation to the reference system. For this purpose, the track moving unit is continuously operated while it grippingly engages the track rails to maintain the position of the track in a selected relation to the reference system, and the track is fixed in the maintained position by tamping the ballast with the tamping tools. This is accomplished according to the present invention by continuously moving the tamping tools relative to the continuously advancing machine frame to hold respective tamping tools in respective cribs during the tamping of the ballast in the cribs while the machine advances continuously.

While continuous lining of tracks has been proposed, track correction is combined with track tamping in the continuous method of this invention since track leveling is not effective without tamping, i.e. fixing the leveled track in the corrected position.

Track tampers with tamping tool units which are movable relative to the machine frame or wherein alternate tamping tool units are used have also been proposed but none of these procedures of machines have successfully solved the problem of so controlling and coordinating all working tools of the machine that a truly continuous track level correction and fixation is accomplished.

A number of modifications in mobile track tamping machines of the above described type may be used to obtain the above results, as will appear in the following description of now preferred embodiments. In essence, such a machine comprises a machine frame mounted on the track for continuous advancement therealong in a working direction. A track moving unit designed to raise and, if desired, to line the track is arranged on the frame for continuous gripping engagement with the track rails while the machine continuously advances, and a reference system is associated with the track for correcting the position thereof in relation to the reference system. A control element indicates the position of the track and cooperates with the reference system for operating the track moving unit to maintain the position of the track in a selected relation to the reference system determined by the cooperation of the control element with the reference system. A plurality of vibratory tamping tools are spaced from each other in the direction of track elongation according to the spacing of the cribs and mounted on the machine frame for relative movement in relation thereto in this direction. Means is provided for continuously operating the track moving unit in response to the control element, and a controlled drive moves the vibratory ballast tamping tools relative to the machine frame.

The above and other objects, advantages and features of the present invention will be more fully understood by reference to the following detailed description of certain now preferred embodiments thereof, taken in conjunction with the accompanying drawing wherein

FIG. 1 is a side view of one embodiment of a track leveling and tamping machine according to this invention, showing a modification in broken lines;

FIG. 2 is a side view of combined track leveling, lining and tamping machine embodying the invention;

FIG. 3 is a top view of the machine of FIG. 2;

FIGS. 4 and 5 are side views of two further embodiments of apparatus according to the invention; and

FIG. 6 is a top view of the embodiment of FIG. 5.

Referring now to the drawing, wherein like reference numerals designate like parts operating in a like manner in all figures to avoid redundancy in the description. FIG. 1 shows a mobile track leveling and tamping machine comprising a machine frame 1 of considerable length. The elongated machine frame is supported at its

respective ends by running gears 2, 2 for mobility on the track, a machine frame portion of considerable length being suspended over the track section to be leveled and tamped. The running gears may be swivel trucks, if desired. The track consists of rails 3 and ties 4 supported on ballast (not shown). In accordance with the method of the present invention, the machine moves forwardly continuously while work is done on the track by the tools supported thereon, the working direction being indicated by the overhead arrow pointing to the right in the drawing.

As is well known in track working machines of this general type, a track lifting unit 5 is mounted on the forward portion of the machine frame in association with each rail 3. The illustrated unit is conventional and comprises coperating pairs of rollers which engage each rail and thus clamp the rail therebetween while the machine moves and without interference with such movement. A hydraulic motor comprising cylinder 6 and vertically movable piston 7 is connected to these units to move the same vertically, the hydraulic fluid supply to the motor being controlled by a grading reference system in a known manner to lift the track to the desired grade.

This reference system, which may take any suitable form, is illustrated as a conventional system comprising an emitter 8 of radiation, such as a beam of infrared rays or a laser beam, and a receiver 9 of the emitted beam of radiation, this beam between the emitter and receiver forming a reference 10 over the track section to be leveled or graded. As shown, the beam emitter 8 is mounted on a support rod 11 which is vertically movable in a vertical trackway in the front portion of machine frame 1 and rides on rail 3 on a roller, thus to indicate the rail level. The beam receiver 9 is also mounted on a support rod, the rod 16 is similarly running on rollers on the rail, the support rod 16 being mounted on brackets at the rear end of the machine frame and also being freely movable vertically. In this manner, the front point 8 of the reference 10 reflects the level of track in an uncorrected track section in advance of the machine while the end point 9 of the reference reflects the level of the corrected track section.

While the above described embodiment of the reference system moves continuously and in unison with the machine while work is done on the track, a modification of the mounting of the front point of the reference line for movement independently the movement of the machine is shown in broken lines.

In this modified machine, a beam emitter 8' is mounted on a self-propelled front bogie 13 which has its own drive 12 and supports the emitter 8' on rod 11'. The speed of drive 12 is radio controlled so as to select the distance between the front bogie carrying beam emitter 8' and the machine, which makes the reference system more flexible and adaptable to various track conditions, as is known. Also, with such a control, emitter 8' may be moved synchronously with the machine frame 1, i.e., at the same speed, so as to maintain a constant distance between the emitter and the machine frame, or the bogie 13 may be moved at a different speed to synchronize its movement with that of the track tamping means (which move in a manner to be described hereinafter in relation to the machine frame). The fixed position of the reference system in relation to the track tamping means during tamping, i.e., while the track is fixed in its leveled position, is of advantage for the accuracy of the operation.

The radio control of the speed of drive 12 is illustrated by a radiowave emitter 14 mounted on the tamping tool carrier frame 18 for movement in unision therewith and the radiowave receiver 15 fixedly mounted on bogie 13, such radio control being conventional and requiring no further description since it forms no part of the invention, except in the claimed combination.

As is also known, a track correction control element constituted by a stop or beam sensing member 17 is mounted on the frame adjacent the path of the reference beam 10. This stop is also mounted on the frame for free vertical movement and also runs on a roller on the track rail to indicate or reflect the level of the rail at this point which is chosen close to the tamping means where the track is fixed in the leveled position. When the rail has reached the desired level, the stop 17, which moves up with the rail on which it rests, will intersect the beam, thus producing a control signal emanating from beam receiver 9 which terminates the operation of motor 6, 7, i.e., the lifting of the track, and may also be used, if desired, to terminate the operation of the tamping means adjacent the stop 17.

All of the above-described structure is conventional and forms part of the present invention only inasmuch as it is combined with the mounting arrangement of the track tamping means which will now be set forth.

The embodiment of this invention shown in FIG. 1 comprises two adjacent tamping tool carrier frames 18 and 26 mounted adjacent each other on the elongated machine frame 1 for relative movement thereto. The frames 18 and 20 are glidingly supported on frame 1 by means of elongated guide beams 20, 20 to enable the frames 18 and 20 to be moved relative to the machine frame 1 in the direction of track elongation, i.e., in the working direction of the continuously moving machine. A track tamping tool carrier mounting of a similar type is shown in our U. S. Pat. No. 3,380,395, dated Apr. 30, 1968, entitled "Apparatus for Tamping Ballast."

The support frame 18 is movable along guide beams 20, 20 which constitute a trackway for the frame along the direction of elongation of the machine frame 1, by means of hydraulic motor 19, the cylinder of which is fixedly mounted on the frame 1 while the slidable piston rod is linked to the frame 18. A tamping tool carrier 22 is vertically movably mounted on vertical columns forming part of the frame 18, the tamping tool carrier supporting groups of tamping tools 21 vibrated by a common eccenter shaft 23. The particular tamping means schematically shown in the drawing is of the type fully described and claimed in our U. S. Pat. No. 3,357,366, dated Dec. 12, 1967, entitled "Track Tamping Machine," and including two pairs of opposed tamping tools. The pairs of tools are spaced from each other in the direction of elongation of the track (and the machine frame), the spacing between the pairs of tools being such that the tools of each pair which are adjacent each other are at a smaller distance from each other than the width of a crib whereby these adjacent tamping tools may be immersed in a crib between adjacent ties. The opposing tools of each pair are arranged for immersion in the ballast adjacent one of the ties when the tamping tool carrier is lowered, with the one tie positioned between the opposing tools, and for reciprocation in the direction of track elongation.

A track sensing element 19' is fixedly mounted at the front end of tamping tool carrier support frame 18 to sense the position of the frame in relation to the track, such sensing element being mounted for contact with respective ties 4, for instance. This sensing element forms part of a control for the operation of motor 19 so that it may be driven until the tamping tools 21 are properly centered in their respective cribs. Upon contact of the tie sensing element 19' with a tie 4, the motor operation will be discontinued to stop the frame 18 in its centered position.

The front end of frame 18 also carries limit switches 24, 24 mounted in alignment, and for cooperation, with facing stops 25, 25 mounted on machine frame 1. When the limit switches contact the stops, the motor 19 will be stopped to discontinue the movement of the fraem 18 in respect to the frame 1. The control circuit for the operation of motor 19 is indicated in broken lines leading from sensing element 19' and stops 25, 25 respectively, to control unit 35 which determines the delivery of pressure fluid to motor 19.

A second tamping tool carrier frame 26 is coupled to frame 18 for movement therewith along the trackway 20, 20, this second frame being mounted rearwardly of the first frame 18 in the working direction of the machine and being additionally movable in relation to frame 18. As shown, a hydraulic motor 32 is arranged to move the frame 26 on the trackway 20, 20, the cylinder of motor 32 being fixed to frame 26 while the slidable piston rod thereof is linked to frame 18 to couple the two frames together. In this manner, the distance between the two tamping tool carrier frames may be varied.

The frame 26 supports a carrier plate 21 whereon surface ballast compactors 27 are mounted for tamping the cribs after the ballast has been tamped underneath the ties by the tamping means 21. The tamping tool carrier plate 31 may be vertically moved by hydraulic motor 28, and the carrier plate is vibrated by an eccenter shaft 30, the vibrating compactors being under the bias of compression springs 29 during the tamping operation. Tamping means of this general type is also well known, neither of the illustrated tamping means on carriers 18 and 26 forming part of the invention, except in the claimed combination.

The rear end of frame 26 carries a limit switch 33 in alignment, and for cooperation, with stop 34 on machine frame 34 to control the independent movement of frame 26 by motor 32 in a manner similar to the control described in connection with motor 19. This control circuit also includes the operation of the eccenter shafts 23 and 30, as shown in broken lines, the electrical control system for the hydraulic motors hereinabove described being quite conventional.

The track leveling, lining and tamping machine shown in FIGS. 2 and 3 differs, in substance, from the machine of FIG. 1 only in the mounting arrangement for the tamping means, except for the provision of a conventional reference system for lining and of conventional lining means.

While the reference system controlling the lining of the track may take any suitable form, it has been illustrated by a reference line 37 extending between the rear bogie 16 and the front bogie 13 which constitute the two end points of the reference system. The reference line 37 is preferably a tensioned wire whose position is taken at measuring point 38 to control the lining, for instance in the manner described and claimed in our U. S. Pat. No. 3,314,373, dated Apr. 18, 1967, entitled "Method and Apparatus for Aligning Track." As is also well known, the rail gripping roller units 5, 5 may be interconnected by a horizontally extending hydraulic motor so as to shift the track in either lateral direction, depending on the operation of the motor (not shown) in response to the position of tensioned wire 37 at point 38.

In the generally conventional reference system shown in FIGS. 2 and 3, the reference for the leveling operation includes only a single beam emitter 8*a* mounted on support rod 11 on front bogie 13, the emitter sending a beam of radiation of sufficient width to reach the two receivers 9*a*, 9*a* associated with respective rails 3 of the track at the rear of the machine. The front bogie is coupled to the front end of the machine at a fixed distance by spacing rod 13'. If desired, the beam emanating from emitter 8*a* may be a planar laser beam forming a reference plane for controlling the level of the track.

Optionally, two additional stops 17' and 17'' associated with respective tamping tool carrier frames 36, 36' may be mounted on these frames in a manner similar to that described in connection with the mounting of stop 17, these stops being arranged in the range of the tamping means so as to improve the accruacy of the leveling operation.

The pair of like tamping tool carrier frames 36, 36' are mounted according to the present invention in the following manner, each frame being associated with a respective one of the rails, as best seen in the top view of FIG. 3. Each of the frames is glidably mounted on trackways similarly to the frames 18 and 26 but the frames are independently and separately movable in the direction of track elongation and in respect of the machine frame 1 by separate hydraulic motors 39.

In this manner, the relative position of the frames 36 and 36' to each other may be selectively controlled. This control may include a mechanical coupling between the carriers and, at any rate, may be so determined that the relative position of the two frames and the tamping means they carry may take any desired form. In the illustrated embodiment, the tamping means on each frame is designed for simultaneously tamping two adjacent ties (as more fully described hereinabove) and the frame may be alternately moved in such a manner that four ties are tamped. As indicated in broken lines, the positions of the frames 36, 36' may be so changed that the tamping means of one frame will be operated to tamp the ballast while the other frame is moved in the direction of track elongation. The relative movement may be so controlled that the tamping means carried by both frames will simultaneously tamp one tie or one crib.

Since the rail engaging gripping roller units 5 are relatively far removed from the tamping means which fix the track in the leveled position, it is preferred to hold the track rails in position at the points of tamping by rail gripping rollers 40 mounted on the underside of frames 36, 36'.

In the machine of FIG. 4, a plurality of individual ballast tamping tools 42 are mounted in tamping tool carrier frame 47 which is fixed in elongated machine frame 1. The tools 42 are sequentially spaced from each other in the direction of elongation of the track and arranged for movement in this direction and in re-

spect of frames 47 and 1. In the illustrated embodiment, each tool 42 has a drive 41, such as an eccenter shaft, for vibrating the tool. The carrier for the tamping tools is an endless conveyor arranged for continuous movement in a vertical plane parallel to the track while the machine advances continuously along the track. The illustrated conveyor is an endless sectional band trained about pulleys 44, 45 one of which is preferably driven to move the endless band 43. Obviously, equivalent endless conveyor means mounted for continuous movement may be used as carrier for the tamping tools, such as a chain, an endless track, a wheel, a rotating wheel and the like. Preferably, the carrier 43 is adjustably mounted on a trackway 48 for moving the entire carrier in respect of the fixed frame 47 in the direction of track elongation.

The spacing of the individual tamping tools 42, which is preferably adjustable, is such that successive tools will be immersed in successive cribs as the endless conveyor 43 moves continuously during the continuous advance of the machine along the track. The direction of the continuous movement of the endless conveyor is such that its lower run, which carries the tamping tools which are immersed in the ballast, moves counter to the forward movement of the machine. Thus, if the speed of movement of the conveyor is the same as the speed of the movement of the machine, each immersed tamping tool will, in fact, stand still in the crib and, by its vibration, tamp the ballast in the crib. If the speed of the conveyor is increased slightly over that of the machine, each immersed vibrating tamping tool 42 will be moved towards an adjacent tie, thus further compacting the ballast underneath this tie.

In the illustrated embodiment, the tamping tools 42 are pivotal levers and drivers 46, shown as hydraulic motors, are connected to each individual tool for pivoting the same so as to press the tool against an adjacent tie, when immersed, and/or to pivot a selected tool into or out of the ballast in any selected crib.

As FIG. 4 shows, while one tamping tool 42 (or a series of such tools) is immersed in a respective crib and is moved by conveyor 43 opposite to the direction of movement of the machine in respect of the machine frame, another tamping tool (or a series of such tools) on the upper run of the conveyor is moved by the conveyor in the direction of movement of the machine in an inoperative position. In other words, as the successive tamping tools are advanced by the conveyor, they move from an inoperative position, wherein they move in the same direction as the machine, into an operative position, wherein they move opposite to this direction. This movement of the tamping tools is relative to the machine frame and the speed of this relative movement may be readily controlled in respect of the speed of the machine movement, such relative movement in respect of the track being zero, if desired.

If the conveyor 43 runs a little faster than the machine, this movement alone will cause the tamping tools immersed in a respective crib to move towards an adjacent tie, i.e., to produce a tamping movement. This tamping movement may be reinforced by operating the drive 46 so as to pivot the immersed tamping tool towards the tie.

Still another embodiment of a track working machine according to the present invention is shown in FIGS. 5 and 6. In this machine, the tamping tool carrier frame 51 is longitudinally movably mounted in the elongated machine frame 1 on trackway 58. The drive for moving the frame 51 in the direction of track elongation in respect of machine frame 1 includes an elongated rack 49 extending the length of the frame 1 and meshing with a pinion 50 mounted on frame 51 and driven by a motor 59.

The frame 51 supports the carrier 57 for all tamping tools associated with the respective track rails, including the tamping tools 52 arranged for immersion in respective cribs for tamping ballast underneath an adjacent tie and surface compactors 54 arranged for compacting the ballast in the cribs previously tamped by tools 52. The tamping tools 52 are similar to those described hereinabove in connection with FIG. 4, i.e., they consist of pivotal vibratory levers which may be individually moved towards an adjacent tie by drives 53.

Each of the tamping tools may be individually moved vertically into engagement with, or immersion into, the ballast by hydrauilc motors 55 operatively connected to respective tools, these tools being vertically movably mounted on carrier 57 which itself may be vertically moved by motors 56, 56.

In the preferred arrangement of the tamping tools, tamping tools 52 and 54 alternate, being spaced from each other so that successive tools work on successive cribs, and the surface compactors 54 being arranged rearwardly of the immersion tools 52 in the preferred working direction indicated by the overhead arrow in full lines.

However, the machine may also be operated in the reverse direction, as indicated by the overhead arrow in broken lines. For this purpose, two track moving units 5, 5 are arranged on the frame 51 at the front and rear end, respectively, the unit at the front end being used in either working direction. The light bogie 13 of the reference system may, of course, be readily moved to the other end of the machine when its working direction is reversed. The same holds true for the bogie 16 carrying receiver 9 which may be positioned in guides 9', 9'' at the other end of machine frame 1.

In this embodiment, contrary to the afore-described machines, the track moving units 5, 5 are mounted on the movable tamping tool carrier frame, i.e., they are movable therewith, rather than being mounted on the machine frame 1. In other words, the track moving unit will move in respect of the machine in the direction of track elongation while the machine continuously advances, remaining at all times in gripping engagement with the track rails to hold the same at the desired level and/or the desired alignment determined by the reference system. The stop 17 of the reference system is also mounted on frame 51 for movement therewith and with the track moving unit. For proper positioning in the reverse working direction, an alternative bearing 17*a* for the support rod of stop 17 is provided near the other end of the frame 51.

In all described and illustrated embodiments of this invention, the ballast tamping tools working in respective cribs during the continuous advance of the machine along the track are continuously moved with substantially constant speed in respect of the machine frame and in a direction opposite to the movement of the machine frame, the speeds of movement of the machine frame and the tamping tools being so synchronized that the tools will remain in the cribs in which they work during the advance of the machine.

All the embodiments of the machine comprise a plurality of vibratory tamping tools spaced successively from each other in the direction of track elongation and movable in this direction in respect of the machine frame. They also include a track moving unit and a reference system for correcting the position, i.e., the level and/or the lining, of the track. Furthermore, they include drive means for moving the tamping tools, the machine frame and the track moving unit, and a control for synchronizing the drive means. The embodiments of FIGS. 1, 2 and 5 furthermore provide a control responsive to the continuous advance of the machine frame along the track for regulating the duration of the tamping in each crib, this control adjusting the speed of the continuous movement of the tamping tool carrier frame first in a direction opposite to the working direction of the machine while successive cribs are tamped and then in the same direction as the machine working direction to move the tools, while lifted out of the ballast, into the next adjacent track section to be worked. Controls of this type are readily within the skill of the art and their specific construction forms no part of the present invention, any suitable and commercially available control being useful, such as relay-controlled electric control circuits operating solenoid valves in a hydraulic fluid supply system if the drives, as illustrated herein, are hydraulic motors.

Also, the machine of the present invention may be used in connection with any suitable reference system commercially available or becoming available for track correction work.

Thus, while some preferred embodiments have been described and illustrated herein, it will be clearly understood that 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 in the appended claims.

We claim:

1. A mobile track tamping machine for correcting the position of a track including two rails mounted on successive ties resting on ballast defining cribs between the ties, which machine comprises

1. a machine frame mounted on the track for continuous advancement therealong in a working direction,
2. a track moving unit arranged on the frame for continuous gripping engagement with the track rails while the machine continuously advances,
3. a reference system associated with the track for correcting the position thereof in relation to the reference system,
   a. the track moving unit being arranged to raise the track in relation to the reference system,
4. a control element indicating the position of the track and cooperating with the reference system for operating the track moving unit to maintain the position of the track in a selected relation to the reference system determined by the cooperation of the control element with the reference system,
5. a plurality of vibratory ballast tamping tools spaced from each other in the direction of track elongation according to the spacing of said cribs and mounted on the machine frame for relative movement in relation thereto in said direction,
6. means for continuously operating the track moving unit in response to the control element,
7. a drive for moving the vibratory ballast tamping tools relative to the machine frame, and
8. a control for said drive.

2. The track tamping machine of claim 1, wherein the track moving unit is arranged to raise the track in relation to the reference system.

3. The track tamping machine of claim 1, wherein the drive for moving the vibratory ballast tamping tools relative to the machine frame is a hydraulic motor.

4. The track tamping machine of claim 1, wherein said machine frame is elongated, front and rear running gears at the ends of the elongated machine frame mount the frame for mobility on the track, and the tamping tools are mounted on the elongated machine frame between the front and rear running gears for vertical movement in relation to the machine frame.

5. The track tamping machine of claim 1 comprising a carrier for the tamping tools, the carrier being mounted for relative movement to the machine frame in said direction.

6. The track tamping machine of claim 5, further comprising a frame supporting the tamping tool carrier, the tamping tool carrier support frame being mounted on the machine frame for relative movement in relation thereto.

7. The track tamping machine of claim 1, wherein said control is responsive to the continuous advancement of the machine frame in said working direction, the control being arranged continuously to drive the tamping tools in response to the continuous advancement alternately opposite to the working direction in synchronization with the advancement, whereby the tamping tools remain in respective ones of said cribs during tamping of the ballast, and in said working direction to move the tamping tools to a successive cribs along the track.

8. The track tamping machine of claim 1, further comprising a first frame supporting one group of said tamping tools, said one group of tamping tools being arranged to tamp the ballast in respective ones of said cribs underneath adjacent ones of said ties, and a second frame supporting another group of said tamping tools, said other group of tamping tools being arranged to compact the ballast in the cribs, the second frame being arranged rearwardly of the first frame in the working direction, and the tamping tool support frames being mounted on the machine frame for relative movement in relation thereto.

9. The track tamping machine of claim 8, further comprising a drive for moving the second frame in relation to the first frame in said direction.

10. The track tamping machine of claim 9, wherein the drive for moving the tamping tools in a common drive for the first and second frames operated by said control, and said control also operates the drive for moving the second frame in relation to the first frame.

11. The track tamping machine of claim 1, further comprising a plurality of frames each supporting a group of said tamping tools, each of said tamping tool support frames being mounted on the machine frame for relative movement in relation thereto, the drive for moving the tamping tools comprising separately controlled drive means for each of said tamping tool support frames.

12. The track tamping machine of claim 1, further comprising two frames each supporting a group of said tamping tools, said tamping tool support frames being

associated with respective ones of said rails, and the control for the drive being arranged to move the frames into selected positions in relation to each other.

13. The track tamping machine of claim **12,** wherein each of said groups of tamping tools is arranged to tamp the ballast in two adjacent cribs simultaneously, and the drive control being arranged to move the frames into the selected positions wherein the tamping tools on both frames simultaneously tamp the same crib.

14. The track tamping machine of claim **1,** further comprising a common frame supporting groups of said tamping tools associated with respective ones of the rails, the tamping tools being vertically movable, and the common tamping tool support frame being mounted on the machine frame for relative movement in relation thereto.

15. The track tamping machine of claim **14,** wherein each of the groups of tamping tools consists of alternatingly mounted tamping tools arranged to tamp the ballast in respective ones of said cribs underneath adjacent ones of said ties and to compact the ballast in the cribs, the alternating tamping tools being spaced in the direction of elongation of the track.

16. The track tamping machine of claim **15,** wherein the tools arranged to compact the ballast in the cribs are rearwardly of the tools arranged to tamp the ballast underneath the ties in the working direction.

17. The track tamping machine of claim **16,** further comprising drive means for moving the tamping tools arranged to tamp the ballast underneath the ties towards said ties.

18. The track tamping machine of claim **1,** further comprising an endless conveyor carrier for the tamping tools, the controlled drive continuously moving the endless conveyor in a vertical plane parallel to the track for positioning successive ones of the tamping tools in respective ones of said cribs.

19. The track tamping machine of claim **18,** further comprising means adjustably mounting the tamping tools on the endless conveyor carrier for varying the spacing therebetween.

20. The track tamping machine of claim **18,** wherein the drive control is arranged so to regulate the speed of the endless conveyor in respect of the speed of the machine advancement that a respective one of the tamping tools remains in the crib during tamping while the machine continuously advances.

21. The track tamping machine of claim **18,** wherein the tamping tools are vibratory levers pivotal about an axis extending transversely to the track, and a drive means is connected to each vibratory lever for pivoting the lever about said axis in a vertical plane parallel to the track.

22. The track tamping machine of claim **1,** wherein the track moving unit is mounted on the machine frame.

23. The track tamping machine of claim **1,** further comprising a frame supporting the tamping tools, the tamping tool supporting frame being mounted on the machine frame for relative movement in relation thereto, and the track moving unit being mounted on the movable frame for movement in unison therewith relative to the machine frame.

24. The track tamping machine of claim **1,** further comprising auxiliary track position holding means, said means being mounted in the range of the tamping tools for continuously gripping the track rails while the machine continuously advances and the tamping tools are operated to hold the track in the corrected position.

25. The track tamping machine of claim **1,** further comprising a frame supporting the tamping tools, the tamping tool supporting frame being mounted on the machine frame for relative movement in relation thereto, and sensing means associated with the tamping tool supporting frame for sensing varying distances between the ties, the sensing means being operatively connected to the control for actuating the drive control in response to the sensed distances.

26. The track tamping machine of claim **25,** wherein the sensing means is a tactile sensing element fixedly mounted on the frame supporting the tamping tools and arranged to contact successive ones of the ties in its path during the continuous advancement of the machine frame.

27. The track tamping machine of claim **1,** further comprising a frame supporting the tamping tools, the tamping tool supporting frame being mounted on the machine frame for relative movement in relation thereto, and said control element being mounted for movement in unison with the tamping tool supporting frame.

28. The track tamping machine of claim **1,** further comprising a frame supporting the tamping tools, the tamping tool supporting frame being mounted on the machine frame for relative movement in relation thereto, said reference system including a movable forward end, and control means for moving the forward end in response to the movement of the tamping tool supporting frame.

29. A mobile track tamping machine for correction the position of a track including two rails mounted on successive ties resting on ballast defining cribs between the ties, which machine comprises

1. an elongated machine frame,
2. front and rear running gears at the ends of the elongated machine frame mounting the frame on the track for continuous advancement therealong in a working direction,
3. a track moving unit arranged on the frame for continuous gripping engagement with the track rails while the machine continuously advances,
4. a reference system associated with the track for correcting the position thereof in relation to the reference system,
5. a control element indicating the position of the track and cooperating with the reference system for operating the track moving unit to maintain the position of the track in a selected relation to the reference system determined by the cooperation of the control element with the reference system,
6. a plurality of vibratory ballast tamping tools spaced from each other in the direction of track elongation according to the spacing of said cribs and mounted on the elongated machine frame between the front and rear running gears for vertical movement in relation to the machine frame and for relative movement in relation thereto in said direction,
7. means for continuously operating the track moving unit in response to the control element,
8. a drive for moving the vibratory ballast tamping tools relative to the machine frame, and
9. a control for said drive.

30. A mobile track tamping machine for correcting the position of a track including two rails mounted on successive ties resting on ballast defining cribs between the ties, which machine comprises

1. a machine frame mounted on the track for continuous advancement therealong in a working direction,
2. a track moving unit arranged on the frame for continuous gripping engagement with the track rails while the machine continuously advances,
3. a reference system associated with the track for correcting the position thereof in relation to the reference system,
4. a control element indicating the position of the track and cooperating with the reference system for operating the track moving unit to maintain the position of the track in a selected relation to the reference system determined by the cooperation of the control element with the reference system,
5. a plurality of vibratory ballast tamping tools spaced from each other in the direction of track elongation according to the spacing of said cribs and mounted on the machine frame for relative movement in relation thereto in said direction,
6. means for continuously operating the track moving unit in response to the control element,
7. a drive for moving the vibratory ballast tamping tools relative to the machine frame,
8. a control for said drive,
9. a carrier for the tamping tools, and
10. a frame supporting the tamping tool carrier,
    a. the tamping tool carrier support frame being mounted on the machine frame for relatively movement in relation thereto.

31. A mobile track tamping machine for correcting the position of a track including two rails mounted on successive ties resting on ballast defining cribs between the ties, which machine comprises

1. a machine frame mounted on the track for continuous advancement therealong in a working direction,
2. a track moving unit arranged on the frame for continuous gripping engagement with the track rails while the machine continuously advances,
3. a reference system associated with the track for correcting the position thereof in relation to the reference system,
4. a control element indicating the position of the track and cooperating with the reference system for operating the track moving unit to maintain the position of the track in a selected relation to the reference system determined by the cooperation of the control element with the reference system,
5. a plurality of vibratory ballast tamping tools spaced from each other in the direction of track elongation according to the spacing of said cribs and mounted on the machine frame for relative movement in relation thereto in said direction,
6. means for continuously operating the track moving unit in response to the control element,
7. a drive for moving the vibratory ballast tamping tools relative to the machine frame, and
8. a control for said drive, a. the control being responsive to the continuous advancement of the machine frame in said working direction and being arranged continuously to drive the tamping tools in response to the continuous advancement alternately opposite to the working direction in synchronization with the advancement, whereby the tamping tools remain in respective ones of said cribs during tamping of the ballast, and in said working direction to move the tamping tools to a successive cribs along the track.

32. A mobile track tamping machine for correcting the position of a track including two rails mounted on successive ties resting on ballast defining cribs between the ties, which machine comprises 1. a machine frame mounted on the track for continuous advancement therealong in a working direction,

2. a track moving unit arranged on the frame for continuous gripping engagement with the track rails while the machine continuously advances,
3. a reference system associated with the track for correcting the position thereof in relation to the reference system,
4. a control element indicating the position of the track and cooperating with the reference system for operating the track moving unit to maintain the position of the track in a selected relation to the reference system determined by the cooperation of the control element with the reference system,
5. a plurality of vibratory ballast tamping tools spaced from each other in the direction of track elongation according to the spacing of said cribs and mounted on the machine frame for relative movement in relation thereto in said direction,
6. means for continuously operating the track moving unit in response to the control element,
7. a drive for moving the vibratory ballast tamping tools relative to the machine frame,
8. a control for said drive,
9. a first frame supporting one group of said tamping tools,
    a. said one group of tamping tools being arranged to tamp the ballast in respective ones of said cribs underneath adjacent ones of said ties, and
10. a second frame supporting another groups of said tamping tools,
    a. said other group of tamping tools being arranged to compact the ballast in the cribs rearwardly of the first frame in the working direction, and
11. the tamping tool support frames being mounted on the machine frame for relative movement in relation thereto.

33. A mobile track tamping machine for correcting the position of a track including two rails mounted on successive ties resting on ballast defining cribs between the ties, which machine comprises

1. a machine frame mounted on the track for continuous advancement therealong in a working direction,
2. a track moving unit arranged on the frame for continuous gripping engagement with the track rails while the machine continuously advances,
3. a reference system associated with the track for correcting the position thereof in relation to the reference system,
4. a control element indicating the position of the track and cooperating with the reference system for operating the track moving unit to maintain the position of the track in a selected relation to the reference system determined by the cooperation of the control element with the reference system,

5. a plurality of vibratory ballast tamping tools spaced from each other in the direction of track elongation according to the spacing of said cribs and mounted on the machine frame for relative movement in relation thereto is said direction,
6. means for continuously operating the track moving unit in response to the control element,
7. a drive for moving the vibratory ballast tamping tools relative to the machine frame,
8. a control for said drive,
9. a plurality of frames each supporting a group of said tamping tools,
   a. each of the tamping tool support frames being mounted on the machine frame for relative movement in relation thereto, and
   b. the drive for moving the tamping tools comprising separately controlled drive means for each of said tamping tool support frames.

34. A mobile track tamping machine for correcting the position of a track including two rails mounted on successive ties resting on ballast defining cribs between the ties, which machine comprises

1. a machine frame mounted on the track for continuous advancement therealong in a working direction,
2. a track moving unit arranged on the frame for continuous gripping engagement with the track rails while the machine continuously advances,
3. a reference system associated with the track for correcting the position thereof in relation to the reference system,
4. a control element indicating the position of the track and cooperating with the reference system for operating the track moving unit to maintain the position of the track in a selected relation to the reference system determined by the cooperation of the control element with the reference system,
5. a plurality of vibratory ballast tamping tools spaced from each other in the direction of track elongation according to the spacing of said cribs and mounted on the machine frame for relative movement in relation thereto in said direction,
6. means for continuously operating the track moving unit in response to the control element,
7. a drive for moving the vibratory ballast tamping tools relative to the machine frame,
8. a control for said drive,
9. two frames each supporting a group of said tamping tools,
   a. said tamping tool support frames being associated with respective ones of said rails, and
   b. the control for the drive being arranged to move the frames into selected positions in relation to each other.

35. A mobile track tamping machine for correcting the position of a track including two rails mounted on successive ties resting on ballast defining cribs between the ties, which machine comprises

1. a machine frame mounted on the track for continuous advancement therealong in a working direction,
2. a track moving unit arranged on the frame for continuous gripping engagement with the track rails while the machine continuously advances,
3. a reference system associated with the track for correcting the position thereof in relation to the reference system,
4. a control element indicating the position of the track and cooperating with the reference system for operating the track moving unit to maintain the position of the track in a selected relation to the reference system determined by the cooperation of the control element with the reference system,
5. a plurality of vibratory ballast tamping tools spaced from each other in the direction of track elongation according to the spacing of said cribs and mounted on the machine frame for relative movement in relation thereto in said direction,
6. means for continuously operating the track moving unit in response to the control element,
7. a drive for moving the vibratory ballast tamping tools relative to the machine frame, and
8. a control for said drive,
9. a common frame supporting groups of said tamping tools associated with respective ones of the rails,
   a. the tamping tools being vertically movable and
   b. the tamping tool support frame being mounted on the machine frame for relative movement in relation thereto.

36. A mobile track tamping machine for correcting the position of a track including two rails mounted on successive ties resting on ballast defining cribs between the ties, which machine comprises

1. a machine frame mounted on the track for continuous advancement therealong in a working direction,
2. a track moving unit arranged on the frame for continuous gripping engagement with the track rails while the machine continuously advances,
3. a reference system associated with the track for correcting the position thereof in relation to the reference system,
4. a control element indicating the position of the track and cooperating with the reference system for operating the track moving unit to maintain the position of the track in a selected relation to the reference system determined by the cooperation of the control element with the reference system,
5. a plurality of vibratory ballast tamping tools spaced from each other in the direction of track elongation according to the spacing of said cribs and mounted on the machine frame for relative movement in relation thereto in said direction,
6. means for continuously operating the track moving unit in response to the control element,
7. a drive for moving the vibratory ballast tamping tools relative to the machine frame,
8. a control for said drive,
9. an endless conveyor carrier for the tamping tools,
   a. the controlled drive continuously moving the endless conveyor in a vertical plane parallel to the track for positioning successive ones of the tamping tools in respective ones of said cribs.

37. A mobile track tamping machine for correcting the position of a track including two rails mounted on successive ties resting on ballast defining cribs between the ties, which machine comprises

1. a machine frame mounted on the track for continuous advancement therealong in a working direction,
2. a track moving unit arranged on the frame for continuous gripping engagement with the track rails while the machine continuously advances,

3. a reference system associated with the track for correcting the position thereof in relation to the reference system,
4. a control element indicating the position of the track and cooperating with the reference system for operating the track moving unit to maintain the position of the track in a selected relation to the reference system determined by the cooperation of the control element with the reference system,
5. a plurality of vibratory ballast tamping tools spaced from each other in the direction of track elongation according to the spacing of said cribs and mounted on the machine frame for relative movement in relation thereto in said direction,
6. means for continuously operating the track moving unit in response to the control element,
7. a drive for moving the vibratory ballast tamping tools relative to the machine frame,
8. a control for said drive,
9. a frame supporting the tamping tools,
   a. the tamping tool support frame being mounted on the machine frame for relative movement in relation thereto, and
   b. the track moving unit being mounted on the movable frame for movement in unison therewith relative to the machine frame.

38. A mobile track tamping machine for correcting the position of a track including two rails mounted on successive ties resting on ballast defining cribs between the ties, which machine comprises

1. a machine frame mounted on the track for continuous advancement therealong in a working direction,
2. a track moving unit arranged on the frame for continuous gripping engagement with the track rails while the machine continuously advances,
3. a reference system associated with the track for correcting the position thereof in relation to the reference system,
4. a control element indicating the position of the track and cooperating with the reference system for operating the track moving unit to maintain the position of the track in a selected relation to the reference system determined by the cooperation of the control element with the reference system,
5. a plurality of vibratory ballast tamping tools spaced from each other in the direction of track elongation according to the spacing of said cribs and mounted on the machine frame for relative movement in relation thereto in said direction,
6. means for continuously operating the track moving unit in response to the control element,
7. a drive for moving the vibratory ballast tamping tools relative to the machine frame,
8. a control for said drive,
9. auxiliary track holding means mounted in the range of the tamping tolls for continuously gripping the track rails while the machine continuously advances and the tamping tools are operated to hold the track in the corrected position.

39. A mobile track tamping machine for correcting the position of a track including two rails mounted on successive ties resting on ballast defining cribs between the ties, which machine comprises

1. a machine frame mounted on the track for continuous advancement therealong in a working direction,
2. a track moving unit arranged on the frame for continuous gripping engagement with the track rails while the machine continuously advances,
3. a reference system associated with the track for correcting the position thereof in relation to the reference system,
4. a control element indicating the position of the track and cooperating with the reference system for operating the track moving unit to maintain the position of the track in a selected relation to the reference system determined by the cooperation of the control element with the reference system,
5. a plurality of vibratory ballast tamping tools spaced from each other in the direction of track elongation according to the spacing of said cribs and mounted on the machine frame for relative movement in relation thereto in said direction,
6. means for continuously operating the track moving unit in response to the control element,
7. a drive for moving the vibratory ballast tamping tools relative to the machine frame,
8. a control for said drive,
9. a frame supporting the tamping tools,
   a. the tamping tool supporting frame being mounted on the machine frame for relative movement in relation thereto, and
10. sensing means associated with the tamping tool supporting frame for sensing varying distances between the ties,
    a. the sensing means being operatively connected to the control for actuating the drive control in response to the sensed distances.

40. A mobile track tamping machine for correcting the position of a track including two rails mounted on successive ties resting on ballast defining cribs between the ties, which machine comprises

1. a machine frame mounted on the track for continuous advancement therealong in a working direction,
2. a track moving unit arranged on the frame for continuous gripping engagement with the track rails while the machine continuously advances,
3. a reference system associated with the track for correcting the position thereof in relation to the reference system,
4. a control element indicating the position of the track and cooperating with the reference system for operating the track moving unit to maintain the position of the track in a selected relation to the reference system determined by the cooperation of the control element with the reference system,
5. a plurality of vibratory ballast tamping tools spaced from each other in the direction of track elongation according to the spacing of said cribs and mounted on the machine frame for relative movement in relation thereto in said direction,
6. means for continuously operating the track moving unit in response to the control element,
7. a drive for moving the vibratory tamping tools relative to the machine frame,
8. a control for said drive,
9. a frame supporting the tamping tools,
   a. the tamping tool supporting frame being mounted on the machine frame for relative movement in relation thereto, and

b. said control element being mounted for movement in unison with the tamping tool supporting frame.

41. A mobile track tamping machine for correcting the position of a track including two rails mounted on successive ties resting on ballast defining cribs between the ties, which machine comprises

1. a machine frame mounted on the track for continuous advancement therealong in a working direction,
2. a track moving unit arranged on the frame for continuous gripping engagement with the track rails while the machine continuously advances,
3. a reference system associated with the track for correcting the position thereof in relation to the reference system,
4. a control element indicating the position of the track and cooperating with the reference system for operating the track moving unit to maintain the position of the track in a selected relation to the reference system determined by the cooperation of the control element with the reference system,
5. a plurality of vibratory ballast tamping tools spaced from each other in the direction of track elongation according to the spacing of said cribs and mounted on the machine frame for relative movement in relation thereto in said direction,
6. means for continuously operating the track moving unit in response to the control element,
7. a drive for moving the vibratory ballast tamping tools relative to the machine frame,
8. a control for said drive,
9. a frame supporting the tamping tools,
   a. the tamping tool supporting frame being mounted on the machine frame for relative movement in relation thereto,
   b. the reference system including a movable forward end, and
10. control means for moving the forward end in response to the movement of the tamping tool supporting frame.

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