March 18, 1969 N. J. MACLEOD 3,433,175

RAILWAY TRACK LIFTING AND TAMPING MACHINES

Filed March 10, 1967 Sheet 1 of 5

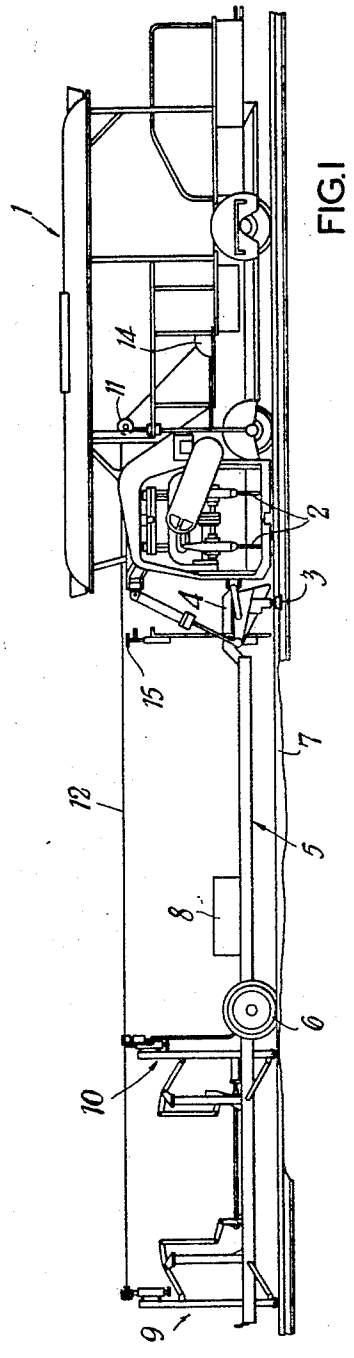

FIG.1

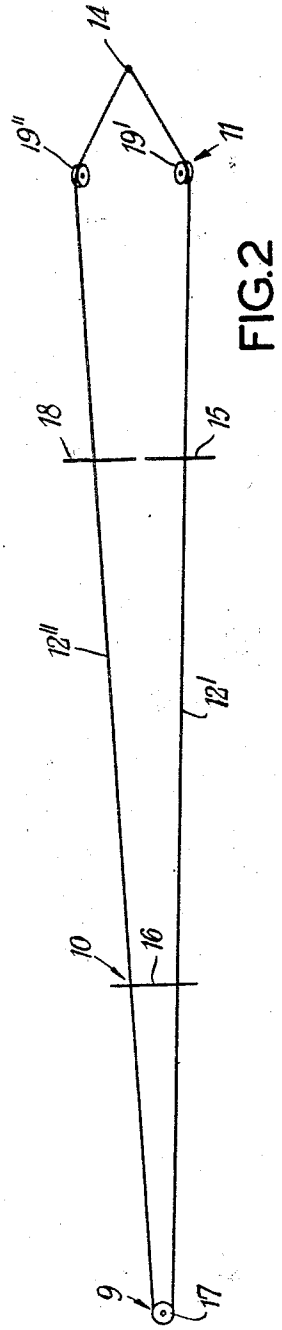

FIG.2

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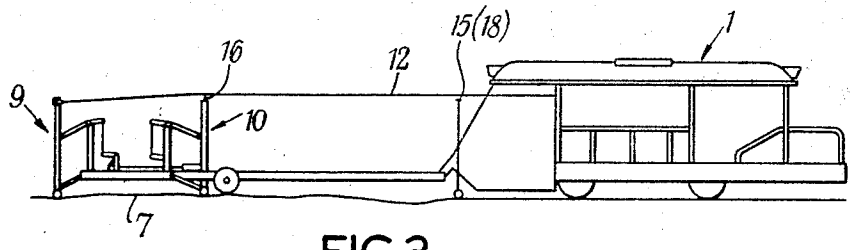

FIG.3

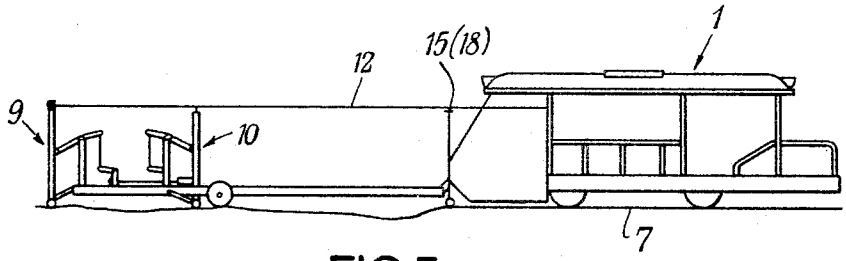

FIG.5

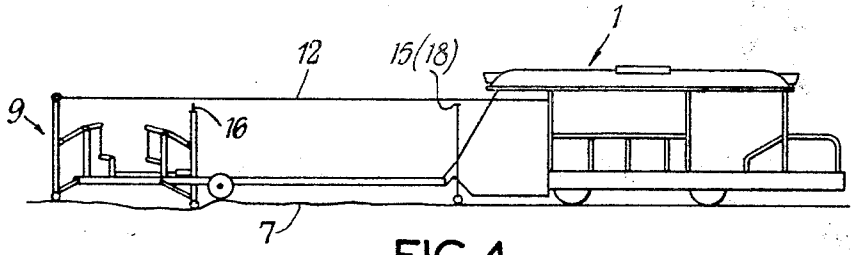

FIG.4

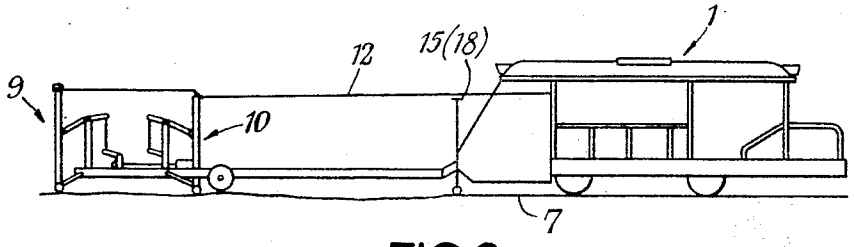

FIG.6

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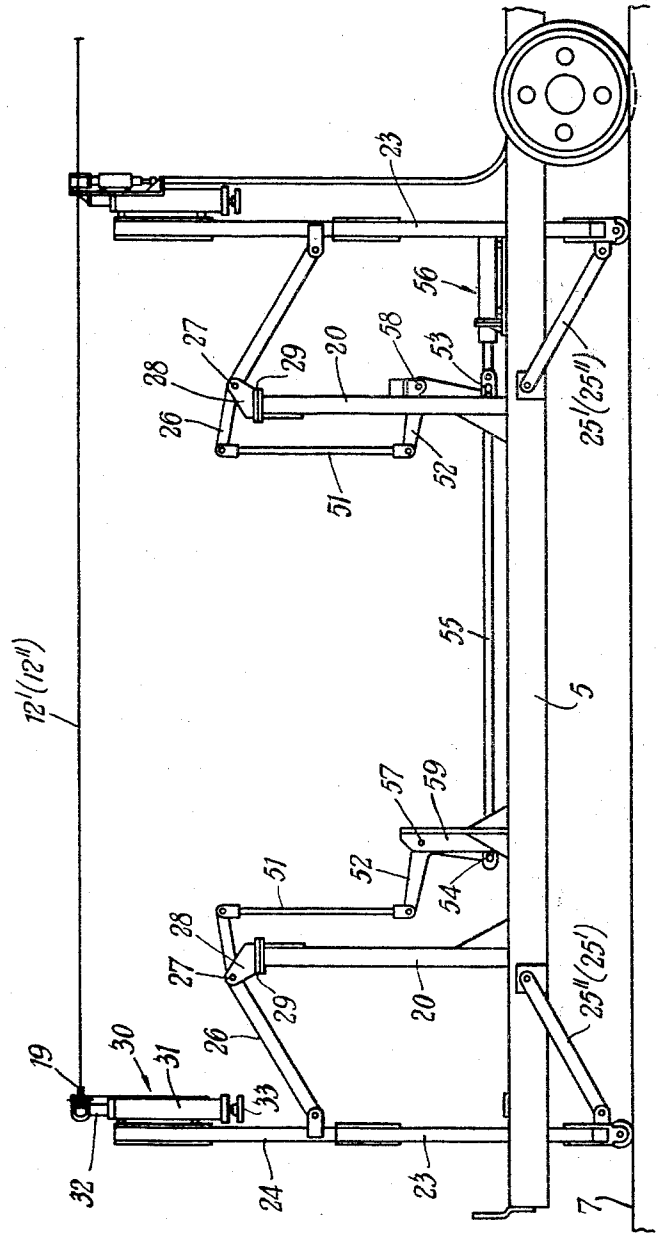

FIG.7

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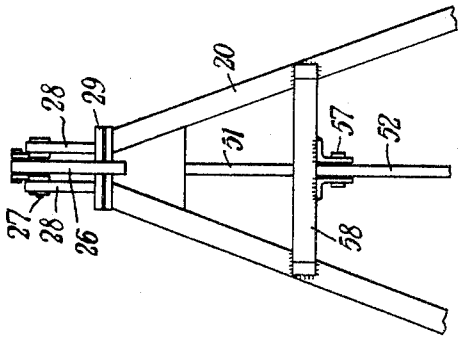

FIG.12

FIG.8

FIG.11

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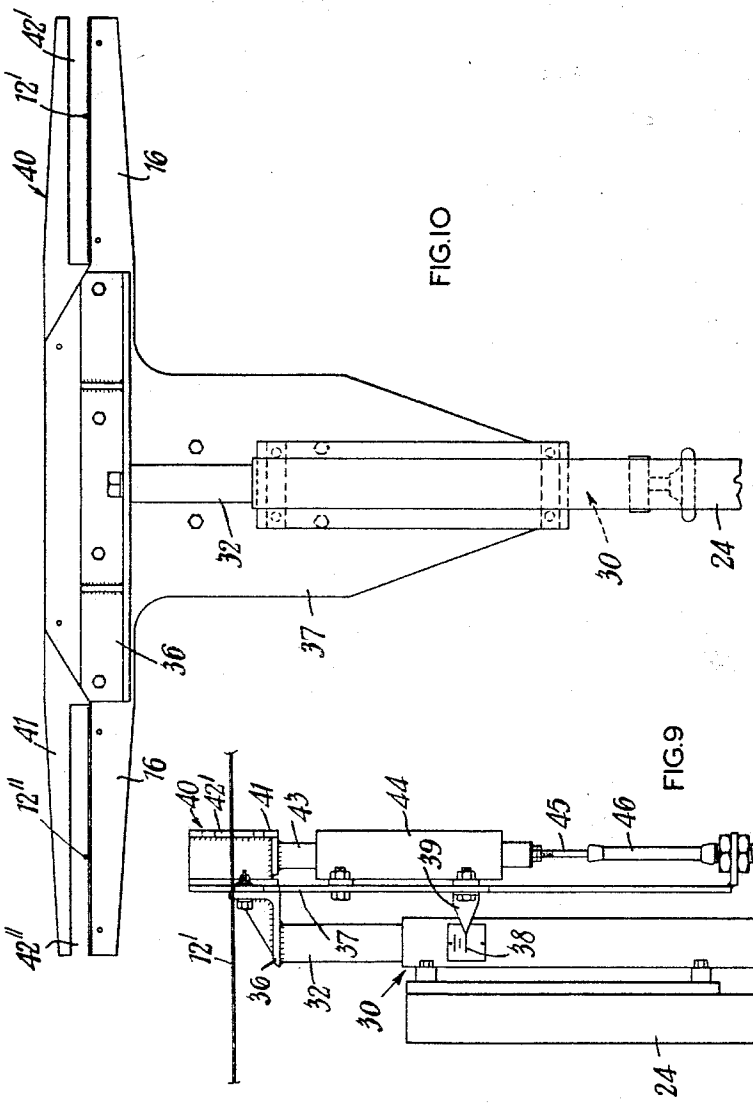

FIG.10

FIG.9

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United States Patent Office 3,433,175 Patented Mar. 18, 1969

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RAILWAY TRACK LIFTING AND TAMPING MACHINES

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Filed Mar. 10, 1967, Ser. No. 622,244
Claims priority, application Great Britain, Mar. 17, 1966, 11,767/66
U.S. Cl. 104—7 14 Claims
Int. Cl. E01b 27/17

ABSTRACT OF THE DISCLOSURE

A railway track lifting and tamping machine arranged in operation to run on the track and comprising lifting apparatus for continuously lifting the track and tampers for tamping ballast beneath the track so lifted as the machine moves along the track, and a datum arrangement associated with the machine for providing a forward datum for controlling operation of the track lifting apparatus.

Background of the invention

Railway track lifting and tamping machines associated with a datum arrangement are already known, the datum arrangement providing a datum related to track profile at a position forward of the track lifting apparatus on the machine. The object of the invention is to provide an improved arrangement for deriving this forward datum.

Summary of the invention

According to the invention there is provided a railway track lifting and tamping machine arranged in operation to run on the track and comprising lifting apparatus for continuously lifting the track to a predetermined level by reference to a forward datum, i.e., a datum which is forward of the track lifting apparatus, as the machine moves along the track, and tampers disposed rearwardly of the track lifting apparatus for tamping ballast beneath the lifted track; wherein a plurality of forward datum determining means are provided and are spaced one forwardly of another along the machine, and are arranged to maintain a fixed spacing along the machine relatively to each other and from the lifting apparatus as the machine moves along the track, and to produce a plurality of datums each related to track level at the instantaneous position of the datum determining means producing it; and wherein means responsive to the varying relationship between said plurality of datums are arranged to cause each of said datums to constitute said forward datum for a respective relationship between said datums.

Description of drawings

FIGURE 1 shows the general arrangement of the tamping machine in side elevation.

FIGURE 2 shows a plan view of the datum wire used.

FIGURES 3 to 6 show diagrammatically different operating conditions of the tamping machine.

FIGURE 7 shows in side elevation the forward part of the separate trolley for carrying the front and intermediate datum determining means.

FIGURE 8 shows in front elevation the front datum determining means.

FIGURES 9 and 10 show in side and front elevation respectively the top of the intermediate datum determining means and associated run-in/run-out bar, the lower part of the intermediate datum determining means being the same as the lower part of the front datum determining means shown in FIGURE 8.

FIGURE 11 shows a side view of the right-hand feeler board associated with the track lifting apparatus, and

FIGURE 12 shows a fragmentary elevation of a detail.

Detailed description of the invention

Referring now more particularly to FIGURES 1 and 2 of the drawings the tamping apparatus proper is of conventional form and comprises a heavily built four-wheeled vehicle **1** with hydraulically operated tampers **2** disposed ahead of the front wheels and with hydraulic track lifting apparatus **3** disposed immediately in front of the tampers **2** and comprising independently operable right and left-hand rail lifters. Connected to the front of the vehicle **1** by connector **4** and extending forwardly therefrom, i.e., in the direction of travel, is a trolley **5** which comprises a horizontal rectangular girder frame supported by a pair of wheels **6** running on the railway track **7**. The trolley **5** carries a ballast box **8** whose position and loading is adjusted to cause the trolley to exert a predetermined vertical load at the connector **4**.

Ahead of the wheels of the trolley is front datum determining means **9** and intermediate datum determining means **10**, which are used in conjunction to produce a forward datum related to track profile. The front and intermediate datum determining means **9** and **10** are described in more detail hereafter, but basically they each comprise a vertical tower structure which engages the track at its lower end and is free to move vertically as its lower end follows the track profile.

Rear datum determining means **11** is provided and comprises a vertical structure extending from the axle of the front wheel-set of the vehicle **1** or alternatively from a special feeler engaging the track between the tamping point and the front wheel-set of the vehicle **1**.

A datum wire **12** extends from the rear datum **11** to the front datum in the manner shown in plan view in FIGURE 2 and its ends are anchored at **14** behind the rear datum. Thus the wire passes from its anchorage **14** over a sheave **19'** at the top of the rear datum determining means **11** over a left-hand feeler or detector board **15**, over the upper edge and towards one end of a cross-bar **16** constituting the top of the intermediate datum determining means **10** and around a sheave **17** at the top of the front datum determining means **9** and returns over the top of the cross-bar **16** towards the other end thereof, over a right-hand feeler or detector board **18** around the other sheave **19''** of the rear datum determining means **11** and then back to the anchorage **14**.

Thus from the rear datum determining means **11** to the front datum determining means **9** the wire in plan forms a V which acts as a two wire system comprising left-hand and right-hand wires **12'**, **12''**; being a single wire ensures that the catenaries on both runs of the wire are substantially the same. The left and right-hand lifters **3** are associated with the left and right-hand feeler boards **15** and **18** respectively which as soon as they contact the datum wire **12** immediately arrest the operation of the associated lifter.

In order to provide run-in and run-out facilities for the tamping machine the intermediate datum determining means **10** is provided with a run-in/run-out bar described in detail hereafter. The run-in/run-out bar does not affect the normal operation of the machine but has the facility under a control from the vehicle **1** for raising the wire **12** at the intermediate datum determining means **10** to provide the necessary run-in slope and for lowering the wire to provide the necessary run-out slope on the rails as will be appreciated by those skilled in the art, the track lifting apparatus always acting to set the track so that it is parallel to the wire at any instant.

It is felt that a brief description of the operation of the machine at this point with reference to the diagrammatic arrangements of FIGURES 3 to 6 would be helpful. FIG-

URES 3 to 6 exaggerate track variations to more clearly illustrate the invention.

During progress of the tamping machine over an irregular track profile, as the front datum determining means **9** moves into a trough or slack, the intermediate datum determining means **10** commences to rise (relatively speaking) and at a certain point engages by the top edge of its cross-bar **16** the wire **12** and so dominates the front datum determining means **9** shown in FIGURE 3 and continues to dominate it during its passage over the high spot. During this period the effective control is between the intermediate datum determining means **10** and the rear datum determining means **11** as shown in FIGURE 3 and the feeler boards **15** and **18** automatically lift to this setting. Thus the intermediate datum determining means **10** provides the forward datum.

As the machine proceeds forward and the front datum determining means **9** travels over a high spot in relation to the general profile of the track, the wire **12** automatically has effect from the front datum determining means **9** to the rear datum determining means **11**, because the wire **12** is out of contact with the cross-bar **16** and the feeler boards **15** and **18** control the lift of the track rails **7** to this set line. Thus in this condition the front datum determining means **9** provide the forward datum and this condition is shown in FIGURE 4. The position of balance when neither the front nor intermediate datum determining means **9**, **10** dominates is shown in FIGURE 5.

It will be thus seen that the configuration of the track profile, when in reasonable relationship to the position of the front and rear datum will be utilised for the forward datum and the troughs in track profile will be excluded from the setting of the lifting apparatus.

In FIGURE 6 is shown the set-up for run-out operation, the run-in/run-out bar having been operated to give the wire a downward slope relatively to the track, so that the track is eventually set to this downward slope.

Reference is now directed more particularly to FIGURES 1 and 7 to 10. Both the forward and intermediate datum determining means **9** and **10** comprise a vertical tower having a lower cross-member **21** (FIGURE 8) at either end of which is a sensing roller **22** running on a respective rail of the track, this roller being of adequate length to allow for operation on curved tracks. Secured at the mid-region of the cross-member **21** is a vertical frame **23** of inverted V form from the apex of which extends a vertical post **24** solidly connected to the frame **23**.

Pivotally connected to the lower cross-member **21** are two lower levers **25'** and **25''** which at their other end are pivotally connected to the trolley **5** (see particularly FIGURE 7). Pivotally connected to the post **24** just above the apex of the frame **23** is a cranked lever **26** which is also pivotable at an intermediate point **27** between webs **28** upstanding from a horizontal turntable **29** (see particularly FIGURE 12) which is mounted on the top of a frame **20** of inverted V form whose limbs are mounted solidly at their lower end to respective side-members of the trolley **5**. The function of the turntable **29** will be described hereafter.

To the upper end of the post **24** of the front datum determining means **9** (see particularly FIGURES 7 and 8) is mounted through a height adjusting mechanism **30** the sheeve **19** around which the datum wire **12** passes. The adjusting mechanism **30** comprises a cylindrical housing **31** secured to the post **24** and through which extends an adjusting bolt **32** carrying the sheave **19** at its upper end and hand wheel **33** at its lower end for effecting adjustment. A scale **34** is provided on the housing **31** and a pointer **35** is connected to the bolt **32** to indicate the height of the sheave relatively to the track **7**.

To the upper end of the post **24** of the intermediate datum determining means **10** (see particularly FIGURES 9 and 10) is bolted a height adjusting mechanism **30** but in contrast to that of the front datum determining means **9** carries at the top of its adjusting bolt **32** through angle bracket **36** a T shaped plate **37** having the cross-bar **16** constituting the top of the datum determining means **10** over which the wire **12'**, **12''** passes. The housing **31** of adjusting mechanism **30** again carries a scale **38** which is different from that on the front datum determining means **9** in that it takes into account the catenary factor of the datum wire **12**. To the down limb of the T shaped plate **37** is secured the pointer **39** for the scale **38** and so indicates the height of the upper edge of the cross-bar **16** in relation to the track **7**.

The height of the sheave **19** of the front datum determinings means **9** and the upper edge of the cross-bar **16** of the intermediate datum determining means **10** are set by the adjusting mechanism **30** so that a predetermined mean lift will be given to track **7**, the height of the upper edge of the cross-bar **16** being automatically set lower than the sheave **19** to take into account the catenary factor of the wire **12**, by the appropriate correlation between the scales **34** and **38**. Having once set the datum determining means **9** and **10** in this way no further adjustment is required during their operation. This operation is as previously described with reference to FIGURES 3 to 6.

The vertical movement of the datum determining means **9** and **10** is constrained by the parallel levers **25'**, **25''** and **26** which as viewed in FIGURE 7 form with the frame **23**, post **24** and frame **20** of their respective datum determining means **9**, **10** parallelogram linkages. If there is a fall across the track at either of the datum determining means **9** and **10** then the sensing roller **22** on one rail of the track **7** will be at a different level from the sensing roller **22** on the other rail. This will automatically cause the associated lower cross-member **21** to move from the horizontal and so cause levers **25'** and **25''** to take up different angles to the horizontal. Rotation of turntable **29** permits the lever **26** to take up its natural inclination to the horizontal, this inclination being the mean of the inclinations of the levers **25'** and **25''**, since the lever **26** is mounted mid-way between the levers **25'** and **25''** transversely of the track **7**. Thus the top of the datum determining means is set to the mean of the difference in level between the rails.

Mounted on the plate **37** of the intermediate datum determining means is a run-in/run-out mechanism **40** (see particularly FIGURES 9 and 10); this comprises a bar **41** extending parallel to the plate **37** and having slots **42'**, **42''** extending from either end thereof through each of which the datum wire **12'**, **12''** extends. The bar is mounted at the upper end of a rod **43** slidable vertically in a housing **44** through which the run-in/run-out mechanism **40** is mounted on the plate **37**. The bar **41**, when inoperative is positioned so that the mid-height of its slots **42'**, **42''** is level with the upper edge of the cross-bar **16** so that it does not interfere with the operation of the intermediate datum determining means **10**. The rod **43** is connected to the tail **45** of a Bowden or Morse type cable **46** which leads to the vehicle **1** and permits raising or lowering of the run-in/run-out bar. When raised the datum wire **12** is lifted by the lower edges of the slots **42'**, **42''** to provide a run-in condition and when lowered is pressed downwardly to provide a run-out condition as shown in FIGURE 6.

The left-hand feeler board **15** is simply a board solidly mounted to the left-hand lifter through suitable frame members. This board is isolated electrically from the rest of the apparatus and has along its top horizontal edge a brass strip which as soon as it contacts the datum wire **12** causes a signal to be produced to arrest operation of the left-hand lifter. The right-hand board (see FIGURE 11) is basically the same as the left-hand board having isolated board **47** with contact strip **48** but it is adjustable in height relatively to that of the left-hand board through a Bowden cable or Morse type cable **49** from the vehicle so that account can be taken of the difference in level existing or required between the right and left-hand rails of the track **7**.

Since the longitudinal spacing between the datum determining means **9** and **10** is not varied during operation of the machine the tensioning of the wire **12** can be accurately set to give a predetermined catenary in the two runs **12'** and **12''** of wire.

Where desired a solid mechanical beam can replace the datum wire **12** between the rear datum determining means **11** and the front and intermediate datum determining means **9** and **10**. This beam will have to be rigid throughout its length and mounted at both front and rear datums so that the beam will be lifted by either front or intermediate datum post **24** as either dominates without restriction from the other.

In the case of a beam control system, such as an infrared or laser beam control system, a beam projector can be mounted at the forward end of the mechanical beam, which would be mounted as above mentioned, allowing the projector height to be varied by either the front datum or the intermediate datum determining means **9** and **10**.

It will be necessary to introduce on the intermediate datum determining means a mechanical linkage to ensure that the leverage between the intermediate datum and the forward datum determining means on the fixed mechanical beam is compensated for. This type of linkage is well known.

By selecting the dominant features in track profile, a more regular forward datum determination is possible than with the presently known arrangement, which is a single forward datum mounted on a 4-wheeled bogie whose setting is governed by the relative heights of the 4 bogie wheels.

By utilising the improvement in the forward datum setting, it is posible to shorten the distance between the front datum and the rear datum without significant loss of accuracy. This enables a rigid forward structure to be constructed and further permits the incorporation of direct control of run-in and run-out settings by means of a mechanism incorporated on the intermediate datum determining means controlled from the operator's position.

The rigid framework further enables the sensitive datum units to be withdrawn from the track by simple retracting linkage, so as not to suffer wear or damage during transit of the tamper between work point and stabling point. Such linkage in the above described example is associated with both datum determining means **9** and **10** and operates from the end of the cranked lever **26** remote from the post **14** as is clearly shown in FIGURE 7. The linkage comprises vertical rod **51**, bell crank **52** pivoted at one end to rod **51** and at its other end having an elongated slot **53** which locates a pin **54** also locating in an elongated slot of pull rod **55** permitting the requisite relative movement between the bell crank **52** and pull rod **55**. The pull rod **55** is common to both datum determining means **9** and **10** and connects at one end to a hydraulic piston and cylinder arrangement **56**. The intermediate pivot **57** of the bell crank **52** associated with the intermediate datum determining means **10** is at the mid point of cross-member **58** of frame **20** (see FIGURE 12) whereas the corresponding pivot **57** of bell crank **52** associated with front datum determining means **9** is on a special frame **59** mounted on the trolley **5** (see FIGURE 7). The hydraulic piston and cylinder **56** is controlled from the vehicle **1** and enables lifting of the front and intermediate datum determining means **9** and **10** so that their sensing rollers **12** do not contact the rail track **7** as the apparatus is being moved to and from the working site. The front and intermediate datums are locked in their raised positions by a hook (not shown) automatically entering the eye **60** (FIGURE 8) on the lower cross-member **21** as the linkage is operated.

The system of the invention namely providing a front and intermediate datum determining means and selecting the dominating one is equally effective whether used with one wire, with two wires, one to each rail, or with two wires coming to a centre point at the front datum as described in detail above or the two wires going to either the left or right-hand rail or any similar configuration.

I claim:

1. A railway track lifting and tamping machine arranged to run on the track and comprising,

lifting apparatus for lifting the track to a predetermined level by reference to a datum forward of the track lifting apparatus as the machine moves along the track,

tampers disposed rearwardly of said track lifting apparatus for tamping ballast beneath the lifted track,

a plurality of forward datum determining means spaced one forwardly of another along the machine and each responsive to the elevation of the track at the position along the track of the respective datum determining means,

means maintaining said plurality of datum determining means with a fixed spacing along the track relative to each other and to said track lifting apparatus as the machine moves along the track,

means responsive at least in part to a selected one of said plurality of forward datum determining means alternatively for defining said datum.

2. A machine as claimed in claim **1**, wherein said forward datum determining means are carried by a two-wheeled trolley arranged to run on the railway track and detachably connected to the part of the machine carrying the lifting apparatus and tampers.

3. A machine as claimed in claim **1**, which further includes a rear datum determining means responsive to the level of the lifted track adjacent said track lifting apparatus, means governed by said plurality of forward datum determining means and said rear datum determining means for defining said datum.

4. A machine as claimed in claim **3**, wherein said datum is provided by a beam projector of radiant energy.

5. A machine as claimed in claim **3**, wherein said datum is constituted by a mechanical beam.

6. A machine as claimed in claim **3**, wherein said datum extends between the front one of said forward datum determining means and said rear datum determining means and is displaceable upwardly by a forward datum determining means disposed intermediately of said front datum determining means and said rear datum determining means when the datum produced by said intermediate datum determining means indicates a higher track level than the datum produced by said front datum determining means; and wherein a detecting arrangement disposed between the rearmost of the forward datum determining means and the rear datum determining means is arranged to be moved vertically in synchronism with said track lifting apparatus and to arrest lifting of said track by said lifting apparatus when it intercepts said datum.

7. A machine as claimed in claim **6**, wherein each said forward datum determining means comprises a tower which is mounted to be displaceable vertically and whose lower end is arranged to contact the track whereby to follow the track profile as the machine moves along the track and whose upper end at least in part defines said datum.

8. A machine as claimed in claim **7**, wherein each said tower is mounted to the machine through levers extending longitudinally of the machine, each lever being pivotable in a vertical plane.

9. A machine as claimed in claim **8**, wherein each said tower has a lower cross-member carrying at each end roller means arranged to contact a respective rail of the track, a pair of said levers being pivoted at one end to said lower cross-member on either side of and equi-distant from the central vertical plane between said rollers or the like means, and at their other ends are pivoted on a common axis transverse of the machine and a third said lever is pivoted at one end to said tower at a higher level than said pair of levers and in said central vertical plane, said third lever at or towards its other end being pivoted to a turntable rotatable in a horizontal plane.

10. A machine as claimed in claim 9, wherein said datum line is defined by a wire which in plan is of V form with the apex of said V at said front datum determining means, and whose ends are anchored at or behind said rear datum determining means, said intermediate datum determining means comprising a cross-bar whose upper edge constitutes the datum thereof, each run of said wire forming one limb of said V passing over said upper edge.

11. A machine as claimed in claim 10, wherein said wire passes round a sheave of said front datum determining means.

12. A machine as claimed in claim 10, wherein a run-in/run-out bar is associated with said intermediate datum determining means and comprises a cross-bar having a horizontally extending slot through which each run of said datum wire extends, said run-in/run-out bar being movable vertically upwards and downwards relatively to said cross-bar of said intermediate datum determining means, whereby the datum wire is engaged by the lower and upper edges of said slot respectively to raise and lower said datum wire and so provide run-in and run-out operating conditions respectively.

13. A machine as claimed in claim 10, wherein said lifting apparatus comprises independently operable lifters for the left and right-hand rails of the track and said detecting arrangement comprises a respective feeler board associated with each lifter and arranged to intercept a respective run of said datum wire to arrest the lifting of the track by its associated lifter, one said feeler board being adjustable vertically relatively to its associated lifter.

14. A machine as claimed in claim 7, wherein said plurality of forward datum determining means are connected by a linkage to a hydraulic actuator for lifting them out of contact with the railway track.

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