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(54) A TRAVELLING MACHINE FOR TAKING UP AND/OR LAYING TRACK PANELS

(71) We, FRANZ PLASSER BAHNBAUMASCHINEN-INDUSTRIEGESELLSCHAFT mbH, of 3 Johannesgasse, Vienna 1, Austria, an Austrian Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

The invention relates to a travelling machine for taking up and/or laying railway track panels consisting of rails and sleepers, more particularly switch panels, complete switches and similar bulky track components, comprising an on-track transport vehicle and a bridge girder which extends substantially above the vehicle, being connected to it by lateral gantry supports, and which comprises at least one supporting arm projecting beyond an end of the vehicle and designed to be supported on the ballast bed by means of vertically adjustable supports, and a full-length guide path for a trolley equipped with adjustable lifting and transporting units and arranged to travel along the bridge girder.

Travelling machines for taking up and/or laying track panels, even with relatively long sleepers, are already known from British Patent No. 697,099, comprising a bridge girder arranged on a vehicle and provided with a supporting arm projecting beyond one end of the vehicle. The projecting supporting arm can be supported during the removal or laying of track panels by supporting shoes capable of being placed on the ballast bed. Trolleys equipped with adjustable lifting and transporting means are provided for lifting and transporting the track panels to be removed or laid along a guide path extending over the entire length of the bridge girder. For picking up the track panels to be taken up by the lifting and transporting means arranged on the trolley, the bridge girder extends over virtually the entire length of the track panel to be taken up. One disadvantage of this machine is that it cannot be used for laying track switch panels which have a considerably greater width than normal track panels. In addition, when track panels are being laid by this machine, traffic on an adjoining track is impeded.

Another known travelling machine for taking up and/or laying track switch panels (German Specification OS 2410718) comprises a bridge-like frame which spans the entire relaying area and is supported at both ends thereof by individual on-track axles in conjunction with an off-track or on-track undercarriage. In this machine, access to the relaying zone from both ends is prevented by the undercarriages of the bridge-like frame. Through the use of the two individual supports for the bridge-like frame. Through the use of the two individual supports for the bridge-like frame, the adjoining parts of the track and the ballast bed are exposed to extemely heavy loads which can cause damage to the rails and the track bed.

An object of the present invention is to provide a machine for taking up and/or laying track panels with which it is possible to carry out track works of the type in question, particularly the replacement of track switch panels, at a high rate of progress whilst, at the same time, minimising interference with rail traffic on adjoining tracks.

According to the invention there is provided a travelling machine for taking up and/or laying railway switch panels and other track panels, comprising an on-track transport vehicle and a bridge girder which extends substantially above the vehicle, being connected to it by lateral gantry supports, and which comprises at least one supporting arm projecting, in use, beyond

one end of the vehicle and designed to be supported on the ballast bed by means of vertically adjustable supports, and a full-length guide path for a trolley equipped with adjustable lifting and transporting units and arranged to travel along the bridge girder, the gantry supports projecting laterally from the two longitudinal sides of the bridge girder and the vehicle being capable of being swung in or out or pivoted about a vertical axis for clearing obstacles or to permit free passage of switch panels transported by the trolley respectively. By this construction of the travelling machine according to the invention, it is now possible, surprisingly easily and advantageously, to obtain a high work rate, particularly in the removal and laying of track panels of considerable width and track switch panels, without any need to close the adjacent track which can therefore remain in service at substantially full capacity. At the same time, the possibility of adapting the working width of the machine to the particular width of the track panel to be taken up or laid enables the space occupied by the machine to be kept to a minimum, with the result that, in many cases, the machine as a whole is also able to advance much more easily and quickly. Another advantage is that, by adjustment of the working width, it is possible in particular to adapt the gantry supports and the transported track panel sections to the particular clearance conditions so that not too much time is lost during the transport of the track panels taken up, and the track panels to be laid, to and from the panel storage facility. By virtue of the face that the area of track to be worked, or relaying zone, is always freely accessible from one end, the ballast bed can be levelled or taken up and cleaned from that end by means by track maintenance machines immediately after the track panel to be dismantled has been lifted, enabling the track possession time available to be utilised to advantage. All in all, the relatively simple construction of the machine according to the invention enables it to be universally used both for transporting and also for laying track panels whose width exceeds the standard width of a track panel.

The bridge girder may consist of a main support extending over substantially the entire length of the vehicle and of two supporting arms which respectively project, pivotably in the transporting plane, beyond one end of the vehicle and which are pivotably connected to the main support, gantry supports capable of being swung in or pivoted or displaced being provided at the two ends of the vehicle and at the ends of the two projecting supporting arms. In this way, it is possible to take up and lay track switch panels at either end of the vehicle, using the supporting arm at that end; other supporting arm arranged over the vehicles is used for guiding the trolley equipped with the adjustable lifting and transporting means for depositing and taking up track panels stored on the transporting plane of the track vehicles or track panels to be deposited.

In this connection, it has proved to be of particular advantage for the bridge girder and the two supporting arms on the main support to be designed in the mirror symmetry and/or to be arranged in mirror symmetry to one another. In this way, it is possible not only considerably to simplify the construction of the machine, but also evenly to distribute the load on the supporting arms, irrespective of their use, and the stressing of the main support. In particular, a machine constructed in this way can be universally used in both directions.

Preferably the gantry supports arranged on one longitudinal side of the bridge girder are designed to be pivoted and displaced independently of the gantry supports arranged on the other longitudinal side of the bridge girder and, preferably, relative to the respectively adjacent gantry supports as well. In this way, the construction of the machine, particularly its width, can be adapted to the particular conditions prevailing during the laying of right-hand or left-hand switches, in addition to which it is also possible to avoid obstacles present on both sides of the track during transport of the track switch panels from a panel assembly facility to the laying or dismantling site or *vice versa*. This is of particular advantage in the region of stations when adjacent tracks are alternately present on one side or the other and the rail traffic on those tracks must not be affected.

In one particularly advantageous arrangement, the gantry supports respectively provided at the ends of one of the two supporting arms pivotable by preferably hydraulic drives, are designed to be pivoted independently of one another about a preferably common vertical pivot, and the two pivotable arms of each supporting arm which are mounted for adjustment about the pivot pin are respectively connected at their other ends in the vicinity of the vertical gantry support members to a supporting assembly which is vertically adjustable, particularly by means of a hydraulic drive, and which is preferably provided with supporting shoes designed to be placed on the ballast bed and/or on a transporting vehicle. By virtue of the fact that it is possible for the gantry supports to be adjusted to different widths in the region of the projecting supporting arms and to be separately supported on the ballast bed, the track switch panel can also be guided through these

gantry supports by its wider end, so that the projecting supporting arm does not have to extend over the entire length of the relaying zone. In addition, the separate vertical adjustment of the supporting shoes provides for adaptation to different levels of the ballast bed, so that along embanked sections of track the side of the embankment may also be used for support.

In another embodiment of the invention, several transport vehicles provided with gantry supports are coupled together to form a train having an overall length suitable for taking up where possible two consecutive switch panels, the bridge girder comprising a main support, of which the overall length is at last greater than the length of a panel, and a supporting arm which projects beyond one end of the train of vehicles and which is supported by the gantry support members, the length of this supporting arm being equal to or less than the length of a switch panel. In this connection, it is of advantage that, despite the new track switch panels transported to the relaying zone, enough space is still available for depositing the old track panels to be taken up, so that the machine can remain in the region of the relaying zone throughout the entire relaying process and does not have to be shunted in complicated time-consuming manoeuvres.

In yet another embodiment, the bridge girder is connected to the vehicle through a pivot bearing arrangement provided in the region of the gantry supports with an axis or rotation extending substantially perpendicularly of the transporting plane and with a pivoting drive for power-operated rotation substantially parallel to the transporting plane and transversely of the longitudinal axis of the vehicle.

By combining the advantages of the displaceable gantry supports with the rotatable arrangement of the entire bridge girder on the vehicle, it is possible with a relatively short bridge girder to take up and lay rack switch panels at both ends of the vehicle with free access from both sides for delivering and removing the track switch panels. In addition, the optional delivery, particularly of track switch panels, via both ends of the vehicle reduces the shunting of track panel transporting vehicles and, hence, the possession of adjoining tracks.

The pivot bearing arrangement may comprise a supporting plate provided with a swivel ring on which the gantry supports adapted to be swung in or pivoted and displaced are arranged, and the pivoting drive is formed by a pinion adapted to be driven by a motor mounted on the vehicle and a swivel ring in the form of a gear wheel, whereby the high turning forces required for pivoting the bridge girder are directly transmitted through the vehicle to the body of the track.

The bridge girder preferably consists of a main support projecting beyond only one end of the vehicle from the region of the pivot bearing arrangement, gantry supports capable of being swung in or pivoted and displaced being provided in the region of the projecting end of the main support, and supporting props are arranged in the region of the rotatable or pivotal and displaceable gantry supports connected to the vehicle, being adapted to be swung out substantially parallel to the transporting plane from both longitudinal sides of the vehicle transversely of the longitudinal axis thereof. By using gantry supports adapted to be swung in or pivoted and displaced transversely of the longitudinal axis of the bridge girder in the region of the projecting end of the main support in conjunction with the laterally pivotable supporting props, the deal load encountered during the removal and deposition of the very heavy track switch panels is favourably distributed over several supporting points, so that it is even possible to take up track switch panels situated laterally of the vehicle and to deposit them in similar zones. In addition, the use of the supporting props during the rotation of the main support about its axis of rotation prevents the axle assemblies from being overstressed on one side during the rotation of the main support.

Finally, it is possible for the main support to project beyond the end of the vehicle by a distance substantially corresponding to half the length of a track panel to be taken up, and for displacement platforms, preferably provided with drives and roller assemblies, to be arranged on the loading surface of the transporting vehicle for displacing track panels transversely of and/or along the transporting vehicle. Despite the extremely short length of the main support, this variant of the invention provides for the satisfactory loading of track switch panels onto the adjoining vehicles whilst at the same time enabling the track switch panels to be suitably positioned by means of the displacement platforms during the transporting operation, for example to avoid local obstacles. In addition, it is sufficient to use only a single extra vehicle for transporting the track switch panel and also the bridge girder (because this extra vehicle takes over the function of a protective waggon), so that the two coupled vehicles are able to travel in transit as normal rail vehicles.

The adjustable lifting and transporting units arranged on the trolley for taking up and depositing or for transporting a track panel along the guide path extending over the entire length of the bridge girder prefer-

ably comprise a girder beam extending longitudinally of the track and provided with several grippers or pairs of grippers arranged one behind the other in the longitudinal direction of the girder which beam is designed to be guided through between the gantry supports or gantry support members. The use of a girder beam protects the track components to be laid or taken up against excessive flexural stressing. This is particularly important in the laying of heavy track switch panels which, in addition, have to be laid with extreme accuracy on account of their heavy stressing.

It is of considerable advantage for the bridge girder to be in the form of a truss girder and for the vertical gantry support members of at least the gantry supports to be provided between the vehicles and the bridge girder to be periodically connected releasably and pivotally to the pivotable arms associated with the vehicle and with the bridge girder, particularly for depositing or taking up track panels from regions adjacent the longitudinal sides of the vehicle. By releasing or pivoting at least the vertical gantry support members the track panels can also be unloaded or taken up without interference laterally of the waggons. Using the projecting supporting arms and their lateral pivoting movement, even the new track panels to be laid or unloaded can be taken up and deposited by the machine from and in regions situated laterally of the longitudinal side of the vehicles. This also enables track panels to be laid over a larger area laterally of the machine according to the invention, i.e. in the region of adjoining tracks. In this way, it is now also possible for several track or track switch panels laying closely adjacent one another to be taken up and deposited or replaced with the machine standing in one and the same position.

In one particularly advantageous arrangement adjustment and pivoting drives formed by hydraulic cylinder-and-piston assemblies are arranged between the bridge girder or the vehicles and the gantry supports and, for separate and/or common activation (i.e. common to each longitudinal side) are connected through lines to a central control panel accommodated in particular in a central operator's cabin, the drive motors arranged on at least one vehicle accommodating the bridge girder and the hydraulic drives for the supporting assemblies and adjustment drives optionally arranged between the pivotal arms and the vertical gantry support members preferably being controllable from this central operator's compartment as well. This possibility of controlling the individual gantry supports and their vertical gantry support members eliminates the need for operating personnel to be present in the area outside the machine, for example in the extremely dangerous regions bordering the adjoining track, so that the danger of accidents is reduced and rapid, universal adaptation to different take-up and laying sites is made considerably easier. In addition, the rigging and positioning of the machine as a whole are also facilitated by the provision of separate drive motors for the vehicles accommodating the bridge girder.

Finally, the invention also relates to a method for replacing track panels, optionally with treatment of the relaying zone cleared by the removal of the switch panel consisting of sleepers and rails, in a single work cycle by means of the travelling machine described above. The method according to the invention is characterised in that the machine carrying the track switchpanels, which are preferably stored in the rear part of the train formation, is driven up to the area of track to be worked with corresponding lateral adjustment of the gantry supports for clearing obstacles, poles or the like, so that the projecting supporting arm with the gantry support members laterally swung out is situated over the track switch panel to be replaced, after which the supporting assembly is lowered onto the ballast bed substantially in the middle of the track panel to be taken up and on both sides thereof, following which the track panel is engaged by the grippers of the girder beam, lifted up and, with the gantry supports and gantry support members laterally adjusted for the passage of the track switch panel, is carried along the guide path on the bridge girder to the remaining free loading surface, the area of bedding ballast thus exposed being simultaneously treated by a ballast levelling and, optionaly, cleansing machine and the new track panel being taken up during this operation and deposited onto the levelled and optionally, cleaned ballast bed by means of the girder beam.

The main advantage of this method is that, for the first time, the entire relaying process can be carried out in a continuous work cycle without interfering with rail traffic on the adjoining track, in addition to which the time required to carry out the entire relaying process can be kept very short. At the same time, the operations of levelling, taking up or cleaning the bedding material in the relaying zone are with particular advantage integrated into the relaying process as a whole, so that the machines used for carrying out these operations do not interfere with or influence one another, thereby avoiding time losses and enabling an exact and rapid improvement in the track installation to be obtained.

The invention is described in more detail in the following with reference to the

accompanying drawings, wherein:

Figure 1 is a side elevation of a first travelling machine according to the invention for taking up and/or laying track panels, particularly switch panels, during the lifting of a switch panel.

Figure 2 is a plan view of the machine illustrated in Figure 1 additionally showing one of the projecting supporting arms for laterally depositing and taking up track switch panels in its swung-out position.

Figure 3 is a section through the main support and the vehicle accommodating it, on the line III-III in Figure 2.

Figure 4 is a diagrammatic side elevation of another embodiment of a travelling machine according to the invention for taking up and/or laying switch panels.

Figure 5 is a plan view of the machine shown in Figure 4.

Figure 6 shows part of the machine illustrated in Figure 4 on a larger scale.

Figure 7 is a front elevation in section on the line VII-VII of Figure 6.

Figure 8 is a side elevation of a third machine according to the invention for taking up and/or laying track panels, during the lifting of a switch panel.

Figure 9 is a simplified plan view on a smaller scale of the machine shown in Figure 8, showing a vehicle carrying the bridge girder coupled to another track vehicle, and

Figure 10 is a front elevation of the machine on a larger scale along the line X-X in Figure 8.

Figures 1 and 2 show a machine 1 for taking up and/or laying track panels, in particular switch panels 4 consisting of rails 2 and sleepers 3. This machine consists of an on-track transporting vehicle 5 and a bridge girder 10 which, by way of gantry supports 6, 7, 8 and 9, extends above and at a distance from the panel-transporting plane of the vehicle 5. At each end of a main support 11 supported on the vehicle 5 through the gantry supports 6 to 9, a respective projecting supporting arm 12, 13 is mounted to pivot about a pin 14 extending substantially perpendicularly of the transporting plane. A gear ring is arranged on each supporting arm 12, 13 in the vicinity of the pivot pin 14, co-operating with a pinion mounted on the main support 22 for pivoting the supporting arm substantially parallel to the transporting plane and transversely of the longitudinal axis of the bridge girder. The pinion is connected to a drive 15 in the form of an electric or hydraulic motor or the like.

Two gantry supports 16, 17 capable of being swung in or pivoted or slidably displaced are arranged at those ends of the supporting arms 12, 13 opposite the pivot pins 14. In the machine shown, the gantry supports 16, 17 include pivotable arms 18, 19 which are connected to the supporting arms 12, 13 through vertical pivots 20 and pivoting drives 21, 22 formed by hydraulically operable cylinder-and-piston assemblies; at the outer ends of the arms 18, 19 there are vertical gantry support members 23, 24 provided with supporting assemblies 26 with supporting shoes 25.

The main support 11 and the two supporting arms 12, 13 are provided with a full-length guide path 27 for a trolley 28. The trolley 28 is adapted to travel along the guide path 27 under its own power (drive 29) and is provided with a lifting and transporting unit comprising a girder beam 31 which extends longitudinally of the track and on which several grippers or pairs of grippers 32 are arranged in the longitudinal direction of the girder.

The gantry supports 6 to 9 consist of lower and upper pivotable arms pivotally connected to the vehicle 5 and to the main support 11 respectively by vertical pivots 33 extending substantially perpendicularly of the transporting plane, and interconnected by vertical gantry support members 34. Each vertical gantry support member 34 is mounted at one end on one of the two associated pivotable arms through a horizontal pivot pin 35 extending substantially perpendicularly of the pivots 33 and may be opened or swung out about the pin 35 by means of an adjustment drive; a releasable fastening, such as a screw-bolt joint or a bayonet joint, is provided at the other end of each gantry support member 34.

For pivoting the gantry supports 6 to 9 about pivots 33, their upper pivotable arms are connected to the main support 11 through pivoting drives 36 formed by hydraulically operable cylinder-and-piston assemblies.

For independent advance of the machine as a whole, the vehicle 5 is provided with a central drive source 37 from which drive motors 38 for advancing the machine in the direction of the arrows 39 are powered and which is designed to provide for the various adjustment and pivoting drives. A central operator's compartment 40 with a central control panel for example is also provided in the region of this central drive source 37.

For better understanding, the work cycle involved in the use of the machine 1 for taking up a track switch panel 4 will now be described with reference to Figure 2.

The machine 1 is brought into the region of the track switch panel 4 to be taken up, by means of the on-track vehicle 5. The front support arm 12 projects beyond the forward end of the vehicle 5, the pivotable arms 18, 19 of the gantry supports 16, 17 associated with the arm 12 are aligned parallel to the longitudinal axis of the bridge

girder, and the supporting assemblies 26 thereof are raised. The rear supporting arm 13 is supported via its supporting assemblies 26 on a transporting vehicle 41 coupled to the vehicle 5. On arrival at the work site, the arms 18, 19 of the supporting arm 12 are laterally pivoted by the pivoting drives 21, 22 so that the supporting shoes 25 are situated on both sides of the panel 4 to be taken up. The supporting shoes 25 are then lowered onto the ballast bed so that the front supporting arm 12 is supported on the ballast bed on both sides of the panel 4. Thereafter the panel 4 is engaged by the grippers or pairs of grippers 32 of the girder beam 31 and lifted by means of cable winches of the lifting and transporting unit 13. After it has been taken up, the panel 4 is carried along the guide path 27 towards the vehicles 5, 41 by means of the trolley 28 moved by the drive 29. To allow unimpeded passage of the panel 4 and the girder beam 31 carrying it, the gantry supports 6 and 7 are swung out laterally transversely of the longitudinal axis of the girder, by means of the pivoting drives 36. After the track switch panel 4 has been raised, the top of the ballast bed may be levelled by means of a scraper chain 83 (shown in broken lines in Figures 1 and 2), for example of a ballast cleaning machine.

The swung-out position of the gantry support 7 is shown in solid lines in Figure 3. This Figure also shows that the track switch panel 4 can thus be passed freely between the gantry supports 7, 8 and 6, 9.

Once the track panel has been taken up, the supporting shoes 25 of the front supporting arm 12 are lifted off the ballast bed and the entire machine 1 is advanced to the panel assembling and dismantling site. Since the track panels are wider than the standard loading gauge or clearance profile, obstacles at the side of the track, such as overhead cable posts 42 or the like (Figure 3), are avoided by laterally shifting the switch panel 4 and correspondingly pivoting one or more gantry supports 6 to 9 independently or together, as indicated in chain lines and dash-dot lines in Figure 3. The lateral shifting of the track switch panel 4 may be effected by or at the same time as the pivoting of the gantry supports 6 to 9. The control of the pivoting drives 21, 22, 36 of individual or several gantry supports 6 to 9, the drives 15 of the supporting arms 12, 13 and the lowering drives for the supporting shoes 25 may be carried out from the central operator's compartment 40.

On arrival at the panel assembly and dismantling site, the rear supporting arm 13 is swung out laterally about the pivot 14, for example into the position shown in chain lines in Figure 2, by means of the drive 15 and is supported on the ground by its supporting shoes 25. The vertical gantry support members 34 of the gantry supports 6 and 7 which are on the same side of the vehicle 5 as the swung-out supporting arm 13 are then opened, as shown in chain lines in Figure 1 for the gantry support 6, and the trolley 28 is driven along that part of the guide path associated with the supporting arm 13. The track panel switch panel 4 may then be deposited laterally adjacent to the vehicles 5, 41 in the position shown in chain lines. Accordingly, unloading can be carried out without the assistance of fixed crane installations. Thereafter a new track panel may be taken up for installation in place of the track panel 4 which has been removed, for which purpose the reverse procedure is adopted.

Figures 4 and 5 show a machine 43 in which several transporting vehicles 48 each provided with gantry supports 44, 45, 46, 47, and another transporting vehicle 49, are combined with one another to form a train 50. The overal length of the train in such that it is able to take up two consecutive track switch panels. A bridge girder 51 is supported above the transporting plane of the transporting vehicle 48 by the gantry supports 44 to 47. The bridge girder 51 is formed by a main support 52 and a supporting arm 55 connected to the main support 52 to form a unit, the supporting arm 55 projecting beyond the end of the train 50 and being provided with gantry supports 53, 54. The main support 52 and the supporting arm 55 are provided with a full-length guide path 56 for a trolley 57. This trolley is provided with a girder beam 59 serving as the lifting and transporting unit 58.

The gantry supports 44 -47 are generally C-shaped and are designed to pivot transversely of the longitudinal axis of the main support about pivots 60 extending substantially perpendicularly of the transporting plane of the transporting vehicles 48, 49. Thus, when at last those gantry supports which are arranged on one side of the train are in the swung-out position, even the long sleepers of track switch panels have free passage in the longitudinal direction of the main support. Similarly, the gantry supports 53, 54 at the projecting end of the supporting arm 55 can be adjusted to a corresponding spacing transversely of the support, so that the supporting shoes 62 of their supporting assemblies 63, which are vertically adjustable by means of hydraulic drives 61, rest on the ballast bed on both sides of the track switch panel 4 to be taken up. In this way, the gantry support members 65 can be adjusted to any required transverse spacing. For taking up the track switch panels 4, the girder beam 59 is provided with grippers or pairs of grippers 66.

The chain lines on the right-hand side of

Figure 5 represent the scraper chain 71 of a ballast cleaning machine 72 for example of the two-way type, by means of which, immediately after removal of the old track switch panel 4, the ballast bed can be levelled, and optionally taken up, cleaned and re-deposited in uniform distribution during the advance of the machine in the direction of the arrow 73.

Figure 6 shows that the main support 52 and also the supporting arm 55 are formed by a truss girder, the guide path 56 being arranged on the lower flange of this truss girder. As already mentioned, the gantry supports 44 to 47 may be pivoted by means of pivoting drives 74 in the form of piston-and-clyinder assemblies arranged on the transporting surface of the transporting vehicles 48. The two-way ballast cleaning machine 72, i.e. a ballast cleaning machine provided with off-track undercarriages 75 and on-track undercarriages 76 and also with auxiliary undercarriages 77, is diagrammatically illustrated on the right-hand side of Figure 6. The surface of the ballast bed, which is uneven following removal of the track switch panel 4, is levelled by means of the chain 71 and, in the same operation, the ballast taken up is freed from waste spoil and is temporarily stored, for example beside the switch zone, for re-laying after a new track switch panel 78 has been laid (Figures 4 and 5).

Figure 7 shows the gantry supports 47 on one side of the train in the position in which they have been swung out by means of the cylinder-and-piston assemblies 74. It can also be seen from Figure 7 that the clearing width of the chain 71 extends over the entire length of the long switch sleepers. The cleaned ballast awaiting re-laying at the side of the switch zone is denoted by the reference 79.

The work cycle of the machine 43 illustrated in Figures 4 to 7 is as follows:

One or more new track switch panels 78 are loaded onto the transporting vehicle 49 and a transporting vehicle 48. Thereafter the vehicles are brought to the work site either by means of a locomotive or under their own power. During this advance, the gantry supports 44 to 47 (in the case of double-track sections only those gantry supports which are remote from the adjoining track) are swung out laterally to such an extent that the track panels 78 are situated between them. During the advance, it is possible, should local obstacles or construction work of the like so dictate, laterally to pivot the track switch panels 78 and the gantry supports 44 to 47 so that obstacles such as these can be avoided. This is because, in most cases, the width of the track switch panels 78 is greater than the permitted clearance width. On arrival at the work site, the projecting supporting arm 55 is supported on the ballast bed by means of the supporting assemblies 63, by lowering the supporting shoes 62 by means of the hydraulic drives 61. The two gentry supports 53 and 54 are pivoted transversely of the longitudinal axis of the girder to such an extent that the supporting shoes 62 are situated on both sides of the track switch panel 4 to be taken up. The old track switch panel 4 to be taken up is then engaged and lifted by the gripper or pairs of grippers 66 of the girder beam 59, and is carried by the trolley 57 into the region of the two empty forward transporting vehicles 48, for which purpose the gantry supports 44 to 47 of these transporting vehicles are laterally swung out by means of the pivoting drives 74 to allow passage of the girder beam 59 and the track switch panel 4. The old track switch panel 4 is then offloaded onto the free loading surface of the two forward transporting vehicles 48. Immediately after the track switch panel 4 has been lifted off the ballast bed, the ballast in the exposed bedding zone 80 is taken up and cleaned by the ballast cleaning machine 72. The cleaned ballast 79 is either reintroduced into the switch zone and levelled to form a clean, levelled ballast bed 81, or is deposited beside the switch zone for subsequently filling the sleeper cribs of the new track switch panel 78 to be laid. While the ballast cleaning machine 72 is in operation, a new track switch panel 78 is taken up by the gripper or pairs of grippers 66 of the supporting beam 59 and is carried along the guide path 56 by the trolley 57 into the region of the projecting end of the supporting arm 55. It is then lowered onto the levelled and, optionally, cleaned ballast bed 81. The replacement of old track switch panels 4 by new track switch panels 78 with the associated ballast treating operation takes place in a continuous work cycle.

After the supporting shoes 62 have been lifted by means of the hydraulic drives 61 of the supporting assemblies 63, the entire machine 43 i.e. the train formation 50 can be advanced to the next work site. To this end, it is possible for example, as shown in Figure 6, to arrange a central drive 32 below the loading surface of one of the transporting vehicles 48 for supplying propulsion drives for the individual axles of the machine as a whole. This central drive may also be used to power the other drives for pivoting the gantry supports 44 to 47, 53, 54 and gantry support members and for lowering the supporting shoes 62 and the like both during the removal and laying of switch panels 4, 78 and also during transport of the switch panels 4, 78 from and to the work site.

Figures 8 and 9 show a machine 101 for

taking up and/or laying track switch panels 4. A bridge girder 110 is provided on an on-track transporting vehicle 105 of this machine 1, extending at a distance above the transporting plane of the vehicle by means of gantry supports 106 to 109. The main support 111 forming the bridge 110 is supported via the gantry supports 106 to 109 on a supporting plate 112 of a pivot bearing arrangement 130 which is connected to a shaft 114 and a pivoting drive 115. This pivoting drive 115 consists of a swivel ring 116 in the form of a gear wheel which is connected to the supporting plate 112 and which meshes with a pinion 117 which is connected to a motor arrangement 118. At its projecting end, the main support 111, projecting beyond one end 119 of the vehicle from the pivot bearing arrangement 113, is provided with gantry supports 120, 121 which are adapted to be swung out laterally transversely of the longitudinal axis of the main support and on which are vertically adjustable supports 122 provided with shoes for resting on the ballast bed. In addition, the main support 111 is provided with a guide path for a trolley 123 which comprises a lifting and transporting unit 124 for a track panel girder beam 130 equipped with rail grippers.

In the region of the pivot bearing arrangement 113, supporting props 125 capable of being swung out transversely of the longitudinal axis of the vehicle are pivotally connected to the two sides of the transporting vehicle 105, being provided with shoes for resting on the ballast bed. In addition, panel-displacement platforms 127 with drivable roller arrangements 128 and a drive 129 for adjustment transversely of the longitudinal axis of the vehicle are arranged on the loading surface 126 of the transporting vehicle 125, and as indicated in chain lines in Figure 9 the other transporting vehicle 130 is also provided with displacement platforms 127 of this type.

Figure 10 shows the gantry supports 106-109, 120 and 121 and the supporting propose 125 in their swung-out positions. As can also be seen from Figure 10, the so-called bedding shoes can be supported immediately adjacent to the sleeper ends or on the shoulder of the ballast bed, and the adjustment and pivoting range transversely of the longitudinal axis of the vehicle is gauged in such a way that track switch panels with tracks branching off to the right or left from the straight track can be taken up from and lowered onto the transporting vehicle 105.

The work cycle involved in the removal and laying of old and new track switch panels is as follows.

On arrival at the work site with the main support 111 in the position shown in chain lines, i.e. in the position in which it is entirely situated between the outer ends of the two transporting vehicles 105 and 130, the main support 111 is swivelled from the position shown in chain lines into the working position shown in solid lines after the supporting props 125 of the transporting vehicle 105 have been swung out and lowered. After the supporting props 125 have been lifted of the surface of the ballast bed, the machine with the projecting main support 111 is driven up to the track switch panel 4 to be removed until the near end of the panel 4 is situated immediately in front of the forward end 119 of the transporting vehicle 105. Thereafter the gantry supports 120, 121 are laterally swung out to such an extent that they can be supported on the surface of the ballast bed on either side of the track switch panel 4 to be removed, by means of the supports 122. The trolley 123 with the track panel girder beam is then moved into a position over the panel 4, the girder beam 130 is lowered, and the panel 4 is secured to it by means of the rail grippers. The panel 4 is then raised - chain-line position of the girder beam in Figure 1 - and carried through the gantry supports 106 - 109 on the transporting vehicle 105, which have been laterally pivoted to accommodate the maximum width of the track switch panel taken up, to the transporting vehicle 105 or 130 (dash-dot portion) and is deposited thereon. After the support 122 and the gantry supports 120 and 121 have been returned to their rest position, the machine together with the track switch panel 4 (chain lines) can advance to the offloading site, for which purpose the track switch panel can be laterally shifted transversely of the longitudinal axis of the main support by the platforms 127 operable by means of the hydraulic drives 129, so that in conjunction with the individual manoeuvrability of the gantry supports 106-109 of the main support 111, obstacles can be avoided and, at the same time, the requisite clearance from the adjoining track maintained.

At the offloading/assembly site for the track switch panels, the old track switch panel 4 can be deposited laterally adjacent to the machine by laterally swivelling the main support 111. In addition, by virtue of the fact that the main support 111 can be swivelled through 360°, it is also possible in another operation, after the machine, having deposited the track switch panel 4, has advanced laterally adjacent to the track switch panel 4 to such an extent that the pivot bearing arrangement 113 is situated level with the centre of the track switch panel 4, to swing out the main support through approximately 90° relative to the longitudinal axis of the transporting vehicle 105, so that the track switch panel can be

deposited at, or taken up at, a larger lateral distance from the vehicles 105, 130. The delivery of the new track switch panels and their laying after the profiling of the ballast bed, which can be carried out during the removal of the old track panel and the delivery of the new track panel, takes place in the opposite sequence, the co-operation of the displacement platforms 127 and the laterally pivotable gantry supports 106-109 enabling local obstacles to be avoided and the requisite clearance from the adjoining track to be maintained by the lateral displacement and rotation of the track switch panels on the transporting vehicles 105, 130.

The gantry supports 106-109, 120, 121 and the supporting props 125 may be adjusted and laterally pivoted by means of hydraulic or pneumatic cylinder-and-piston assemblies which may be controlled in such a way that it is possible to manipulate each individual support 106-109, 120, 121, 125 on its own, or all the supports on one side of the vehicle together and relative to those arranged on the other side of the vehicle.

The gantry supports can be laterally adjusted by lateral displacement, rather than by a pivoting movement, e.g. using guide members or the like telescopically displaceable one in another.

In addition, the gantry supports arranged at the projecting end of the supporting arm or arms may also be pivoted about a common axis extending substantially perpendicularly of the transporting plane of the switch panel 4. The individual pivoting drives and hydraulic cylinder-and-piston assemblies for laterally swinging out the gantry supports and the transported track panels, may be controlled centrally and in common with one another, for example for all the gantry supports arranged on one side of the machine or train formation. However, it is also possible to control them individually so that locally narrowly defined obstacles can be avoided simply by pivoting individual gantry supports.

It is of course also possible for the illustrated cable winches and hydraulic cylinder-and-piston assemblies used for the trolleys and their lifting and transporting units which, in some instances, have only been diagrammatically illustrated, to be replaced by any other adjustment mechanisms, for example spindle/travelling nut arrangements or mechanical hoists or the like.

WHAT WE CLAIM IS:

1. A travelling machine for taking up and/or laying railway switch panels and other track panels, comprising an on-track transport vehicle and a bridge girder which extends substantially above the vehicle, being connected to it by lateral gantry supports, and which comprises at least one supporting arm projecting, in use, behind one end of the vehicle and designed to be supported on the ballast bed by means of vertically adjustable supports, and a full-length guide path for a trolley equipped with adjustable lifting and transporting units and arranged to travel along the bridge girder, the gantry supports projecting laterally from the two longitudinal sides of the bridge girder and the vehicle being capable of being swung in or out or pivoted about a vertical axis for clearing obstacles or to permit free passage of switch panels transported by the trolley respectively.

2. A machine as claimed in claim 1, characterised in that the gantry supports arranged on one side of the bridge grider are designed to be pivoted and displaced independently of one another relative to the gantry supports arranged on the other side of the bridge girder and, preferably, relative to the respectively adjacent gantry supports as well.

3. A machine as claimed in claim 1 or 2 characterised in that gantry supports provided at the outer end of the or each supporting arm are designed to be pivoted independently of one another about a vertical pivot.

4. A machine as claimed in claim 3 in which the or each said supporting arm has at its outer end a plurality of gantry supports pivotable independently about a common vertical pivot.

5. A machine as claimed in claim 3 or 4 in which each of the gantry supports pivotable about a said vertical pivot comprises an arm pivotable at one end about the said pivot and provided at the other end with a vertically adjustable supporting assembly capable of resting on the ballast of the track or on a further said vehicle.

6. A machine as claimed in claim 5 in which the pivotable arms have at their said other ends vertical support members on which the supporting assemblies are provided.

7. A machine as claimed in any of claims 1 to 6, characterised in that the adjustable lifting and transporting units arranged on the trolley for taking up and depositing a track panel or for transporting a track panel along the guide path comprise a girder beam extending longitudinally of the track which beam is provided with several grippers or pairs of grippers arranged one behind the other in the longitudinal direction of the girder and which is designed to be guided between the gantry supports.

8. A machine as claimed in any of claims 1 to 7, characterised in that the bridge girder is a truss girder.

9. A machine as claimed in any of claims 1 to 8 in which at least those gantry supports provided between the vehicles and the

bridge girder include vertical support members connected releasably and pivotally about horizontal axes to arms of said gantry support which arms are pivotable about vertical axes and are associated with the vehicle and with the bridge girder, to permit depositing track panels on or taking up track panels from regions adjacent to the sides of the vehicle.

10. A machine as claimed in any of Claims 1 to 9 characterised in that adjustment and pivoting drives formed by hydraulic cylinder-and-piston assemblies are arranged between the bridge girder or the vehicle and the gantry supports and, for separate and/or common activation (i.e. common to each side), are connected through lines to a central control panel accommodated in particular in a central operator's cabin, drive motors arranged on at least one vehicle accommodating the bridge girder and hydraulic drives for the supporting assemblies and adjustment drives optionally arranged between the pivotable arms and the vertical gantry support members preferably being controllable from this central operator's compartment

11. A machine as claimed in any preceding claim in which the bridge girder consists of a main support extending over substantially the entire length of the vehicles and of two supporting arms which project from respective ends of the vehicle and are pivotably connected to respective ends of the main support for pivoting in the plane of transport of the panels, gantry supports capable of being swung in or pivoted or displaced being provided at the two ends of the vehicle and at the ends of the two projecting supporting arms.

12. A machine as claimed in claim 11 characterised in that the bridge girder and the two supporting arms on the main support are designed in mirror symmetry and/or are arranged in mirror symmetry to one another.

13. A machine as claimed in any of claims 1 to 10 characterised in that several transport vehicles provided with respective gantry supports are coupled together to form a train having an overall length suitable for taking up two consecutive switch panels, the bridge girder comprising a main support of which the overall length is at least greater than the length of a panel, and a supporting arm which projects beyond one end of the train of vehicles and which is supported by gantry support members, the length of this supporting arm being equal to or less than the length of a switch panel.

14. A machine as claimed in any of claims 1 to 10 in which the bridge girder is connected to the vehicle through a pivot bearing arrangement provided in the region of the gantry supports on the vehicle, with an axis of rotation extending substantially perpendicularly of the transporting plane and with a pivoting drive for power operated swivelling of the girder substantially parallel to the transporting plane and transversely of the longitudinal axis of the vehicle.

15. A machine as claimed in claim 14, characterised in that the pivot bearing arrangement comprises a supporting plate provided with a swivel ring on which the gantry supports are arranged, and in that the pivoting drive is formed by a pinion driven by a motor arrangement mounted on the vehicle and by the swivel ring which is in the form of a gear wheel.

16. A machine as claimed in claim 14 or 15 characterised in that the bridge girder consists of a main support projecting beyond only one end of the vehicle from the region of the pivot bearing arrangement, gantry supports capable of being swung in or pivoted or displaced being provided in the region of the projecting end of the main support, and in that supporting props are arranged in the region of the rotatable or pivotal or displaceable gantry supports connected to the vehicle, the props being adapted to be swung out substantially parallel to the transporting plane from both sides of the vehicle transversely of the longitudinal axis thereof.

17. A machine as claimed in any of claims 14 to 16, characterised in that the main support projects beyond the end of the vehicle by a distance substantially corresponding to half the length of a track panel to be taken up, and in that displacement platforms, preferably provided with drives and roller assemblies, are arranged on the loading surface of the transporting vehicle for displacing track panels transversely of and/or along the transporting vehicle.

18. A method for replacing railway track panels, optionally with treatment of the relaying zone exposed by the removal of the panels, in a single work cycle by means of the travelling machine claimed in any of claims 1 to 17 particularly claim 13, characterised in that the machine carrying the track switch panels which are preferably stored in the rear part of the train formation, is driven up to the area of track to be worked with corresponding lateral adjustment of the gantry supports for clearing obstacles, posts or the like, so that the projecting supporting arm with the gantry support members laterally swung out is situated over the track switch panel to be replaced, after which the supporting assembly is lowered on to the ballast bed substantially in the middle of the track panel to be taken up and on both sides thereof, and in that the track panel is then engaged by the grippers of the girder beam, lifted up and,

with the gantry supports and gantry support members laterally adjusted for the passage of the track switch panel, is carried along the guide path on the bridge girder to the remaining free loading surface, the area of bedding ballast thus exposed being simultaneously treated by a ballast levelling and, optionally, cleaning machine and the new track panel being taken up during this operation and deposited onto the levelled and, optionally, cleaned ballast bed by means of the girder beam.

19. A machine for taking up and/or laying railway track panels, substantially as herein described with reference to Figures 1 to 3 or Figures 4 to 7 of the accompanying drawings.

20. A machine for taking up and/or laying railway track panels, substantially as herein described with reference to Figures 8 to 10 of the accompanying drawings.

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1586016 COMPLETE SPECIFICATION

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Sheet 1

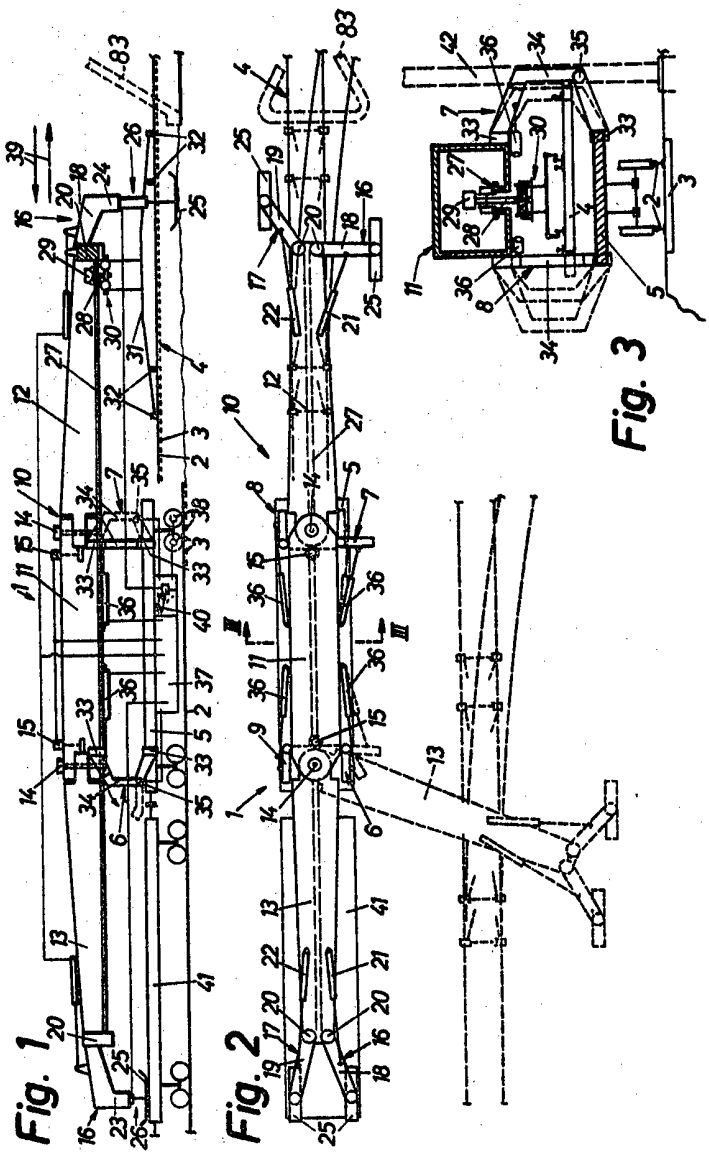
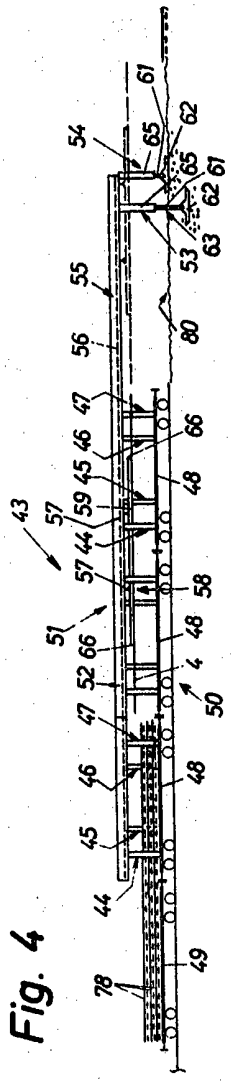


Fig. 1

Fig. 2

Fig. 3



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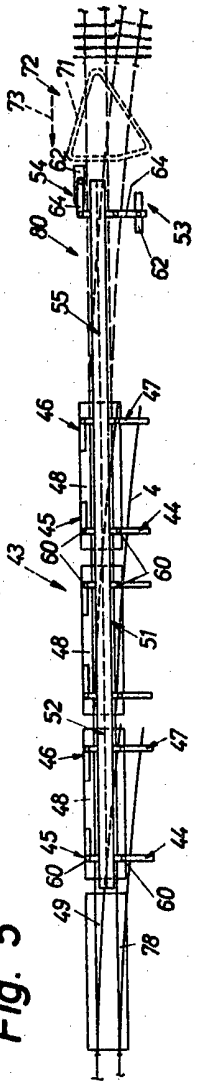
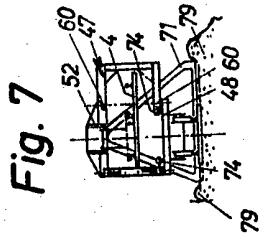


Fig. 5



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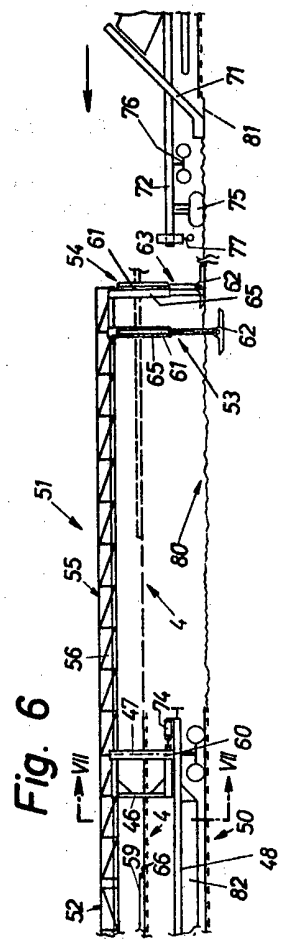

Fig. 6

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Sheet 3

Fig. 8.

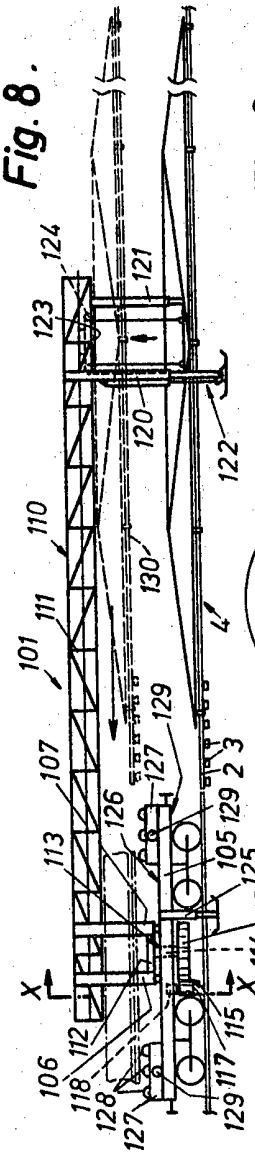

Fig. 9.

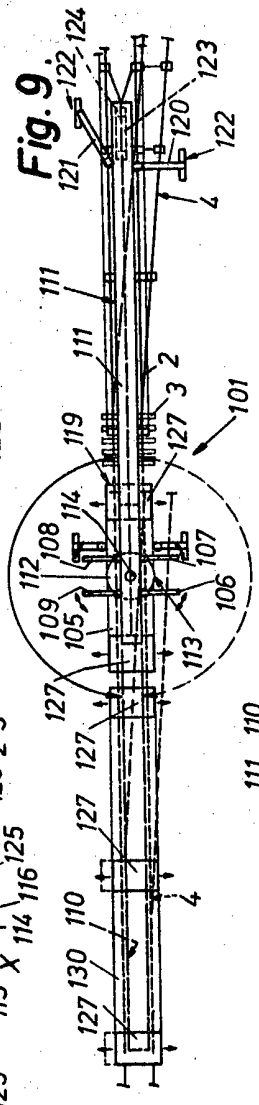

Fig. 10.