

SPECIFICATION

Setting out railway track

- 5 The invention relates to a method of and apparatus for setting out railway track of the kind comprising two parallel side-by-side but spaced rails having a required orientation and position both relatively to one another and
- 10 relatively to a fixed horizontal datum and a fixed vertical datum to accommodate curves and for gradients in the track, each rail being secured to an upper surface of a cast concrete rail base in said predetermined orientation and
- 15 position by a plurality of rail clamps spaced apart along each rail, each clamp of one rail having a clamp of the other rail adjacent thereto on a line normal to the length of the rails and each clamp including support which
- 20 is fixed in the concrete and a clip which engages the clamp support and the rail to locate the rail, hereinafter called "a railway track of the kind referred to".

- Railway track of the kind referred to has
- 25 previously been set out by casting the rail base in concrete and forming pockets in the wet concrete or drilling pockets in the set concrete to locate the supports at required positions for clamping rails. In these circumstances, the setting-out of the base and the
- 30 location of the supports require separate levelling and alignment operations which are complicated and only permit relatively slow laying of railway track of the kind referred to.
- 35 It is an object of the invention to provide a method of and apparatus for setting out a railway track of the kind referred to in which these disadvantages are mitigated.

- According to a first aspect of the invention,
- 40 there is provided a method of setting out a railway track of the kind referred to and comprising the steps of erecting shuttering to define a length of the cast concrete rail base, mounting two clamp supports, one for each
- 45 rail, on a bar so that the clamp supports are held by the bar in orientation and position relatively to one another necessary to give to the two rails to be clamped thereby a required orientation and position relatively to one
- 50 another when secured on the base, placing the bar on adjustable mountings which locate the clamp supports adjacent a required final position of the clamp supports in the base, adjusting the position of the bar relatively to
- 55 the horizontal datum and the vertical datum until the bar, and thus the clamp supports mounted thereon, have the orientation and position necessary to give to the two rails to be clamped by the clamp supports a required
- 60 orientation and position relatively to the horizontal datum and the vertical datum, forming the concrete rail base by filling the shuttering with concrete, the concrete surrounding a part of the clamp supports to hold the clamp
- 65 supports in their required orientation and posi-

tion, so that, after the concrete has set, the rails can be fixed to the base by the clips of the clamps to locate the rails on the base in said required orientation and position both relatively to one another and relatively to the horizontal datum and vertical datum.

- According to a second aspect of the invention, there is provided apparatus for setting out a railway track of the kind referred to and comprising shuttering which defines a length
- 75 of the cast concrete rail base, a bar for holding two clamp supports in the orientation and position relatively to one another necessary to give to the two rails to be clamped
- 80 thereby a required orientation and position relatively to one another when secured on the base by the clamp supports, adjustable mountings on which the bar is placed to locate the clamp supports adjacent the desired
- 85 final position of the clamp supports in the base, the adjustable mountings being adjustable to position the bar relatively to the horizontal datum and the vertical datum until the clamp supports have the orientation and posi-
- 90 tion necessary to give to the two rails to be clamped by the clamp supports a required orientation and position relatively to the horizontal datum and the vertical datum, the filling of the shuttering with concrete forming
- 95 the base and surrounding part of the clamp supports with concrete to hold the clamp supports in their required orientation and position, so rails can be fixed to the base, when set, by clips engaging the clamp supports and
- 100 the rails, the rails then having the required orientation and position both relatively to one another and relatively to the horizontal datum and the vertical datum.

The method and apparatus of the invention

105 allow final position of the rails to be determined before the concrete is cast. A stretch of the track can be set-out in one operation and a highly accurate setting-out achieved.

The following is a more detailed description

110 of one embodiment of the invention, by way of example, reference being made to the accompanying drawings in which:—

Figure 1 is a cross-sectional view of rails of a railway track of the kind referred to in a

115 straight stretch of track,

Figure 2 is a cross-sectional view of rails of a railway track of the kind referred to in a curved stretch of track,

Figure 3 shows a cross-section and *Figure 4* a side elevation of a clamped rail of a railway track of the kind referred to,

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Figure 5 shows a plan view and *Figure 6* shows a side elevation of shuttering and a clamp support of the embodiment of the invention to be described and also show an adjustable bracket of the shuttering,

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Figure 7 is a section on the line VII-VII of Fig. 6,

Figure 8 shows a partial side elevation of

130 the shuttering and bar of Fig. 6, but to a

larger scale than Fig. 6,

Figure 9 is a section on the line IX-IX of Fig. 8,

Figure 10 is a section on the line X-X of Fig. 8,

Figure 11 shows a side elevation and Figure 12 shows a plan of an offset alignment device for use with the bar of Figs. 5 to 9,

Figure 13 is a section on the line XIII-XIII of Fig. 11,

Figure 14 is a section on the line XIV-XIV of Fig. 11,

Figure 15 shows a partial elevation of a foot and a rule of a levelling device for use in the embodiment of the invention to be described,

Figure 16 is a section on the line XVI-XVI of Fig. 15,

Figure 17 is a section on the line XVII-XVII of Fig. 15,

Figure 18 shows a perspective view of a check indicator for use in the embodiment of the invention to be described, and

Figure 19 shows a perspective view of a levelling centre for use in the embodiment of the invention to be described.

Before describing the embodiment of the invention, the following explanation of track work setting out is given with reference to a railway track comprising two spaced rails.

Referring to Fig. 1, the rails 10 are of I-section with an upper surface 11 and side faces 12 which are flared outwardly at a slope of 1 in 20 to a line normal to the upper surface 11.

The two rails forming the track have to be set out with their centre lines having a predetermined orientation and position relatively to one another. This predetermined orientation and position is set by the gauge G of the track and any canting of the rails required. On plain track where there is no horizontal curvature, the centre lines of the rails are canted towards each other at a slope of 1 in 20 so that the inner side faces 12 are parallel. In this case the gauge measurement can be taken over the full width of the side faces.

At junctions and crossings the centre lines of the rails are vertical and thus parallel and the reference point for the measurement of gauge is point R on each inner side face 12 which is 13 mm below the upper surface 11 (see Fig. 3). Where the track is horizontally curved, the track is set out to the inner side face of the inner rail, which is known as the reference rail. This rail will be either level or to a straight grade or to a vertical curve. The outer rail, the non-reference rail, will conform to the inner rail but will have the necessary superelevation S applied, as shown in Fig. 2. These rails will be canted as in plain track. Because of superelevation, gauge measurements between the inner and outer rails are taken from the 13mm point R on the inner side faces 12 of the rails.

The transition between canted and parallel

rails is by means of a twist rail. The length over which the twist occurs is 350mm.

The rails, once they have the predetermined orientation and position relatively to one another must also be correctly orientated and located relatively to horizontal and vertical datum points adjacent the track to fix the track in space as required to make the track level or to a straight grade or vertically curved with any horizontal curvature and associated superelevation required.

For this purpose preliminary track surveying work provides a succession of monuments set along side of the track at suitable intervals such as 10 metres and at all points where track geometry changes. The required position of the track between two adjacent monument points can be calculated as a series of vertical levels V (Fig. 1) and a series of horizontal offsets H (Fig. 1) from a datum.

Referring also to Figs. 3 and 4, the rails are fixed to a cast concrete base 13 which has two parallel plinths 15 (see Figs. 1 and 2), one for each rail 10. The rails are fixed to the plinths 15 by means of clamps of the type for example shown in Figs. 3 and 4 which are sold under the trade name PANDROL. One clamp for one rail comprises two shoulders 16 having a foot 17 embedded in the concrete and having a hole 18 spaced to one side of the rail. The clamp includes two spring clips 19, one for each shoulder. Each spring clip 19 has a portion which engages in the hole 18 of the associated shoulder and a portion which engages the foot of the rail to clamp the rail to one of the plinths 15. Each clamp of one rail has a clamp of the other rail laterally adjacent thereto on a line normal to the length of the rails at that point.

The holes 18 in the shoulders 16 determine the position of the rails and so if the shoulders are correctly positioned in accordance with a desired final position of the rail, the rail when clamped using the supports will have this desired final position.

The clamps clamp the rails at regularly spaced locations therealong. The spacing is a function of the loading upon and the curvature of the track. In the arrangement shown in the drawings the separation is 750mm unless the rails have a horizontal curvature of 600 metres or less when the separation is 600mm. Thus at each clamping position between two adjacent monuments a required level and offset value for the rail can be determined. Where the track is level and straight, the offset value will be constant, as will the level. Where the track has a grade or a vertical curve, once the distance of the first clamping location from one of the monuments has been determined, all levels for the clamping positions up to the next monument can be determined. The offset value will be constant if the track has no horizontal curve.

Where the track is horizontally curved, mea-

surements for each rail are taken from a levelling point L (see Fig. 3) on the upper surface 11 of the rail where the longitudinal plane of symmetry of the rail meets this surface. The level of the levelling point of the inner reference rail at the clamping positions along the rail is determined from one monument. The levels of the corresponding levelling points on the outer, non-reference, rail are derived from the inner rail levels with the addition of a superelevation level S applied at a constant rate from the commencement of superelevation until a constant superelevation is reached and decreased at a constant rate from said constant level to zero as superelevation is removed, over the above any increase in level required by a grade or vertical curve in the track.

The offset values of the clamping locations for a horizontal curve are derived from horizontal dimensions given on the monuments. From these horizontal dimensions a tangent line can be defined which, once the distance of the first clamping position from one of the monuments is known, allows the distances the clamping positions are to be offset from the tangent line to be readily calculated.

Thus at a plurality of spaced locations along the rails the orientation and position of the rails at those locations both relatively to one another and to the datum can be defined by a relative gauge, a relative cant, a level measurement for the levelling point of each rail relative to the datum and an offset measurement for the inner side face of a reference rail relative to the datum. The last two measurements can be calculated by a computer.

These parameters will determine the required positions for the shoulders 18 of the clamps to clamp the rails 10 in position at those locations.

Referring next to Figs. 5 to 10, the embodiment of the invention includes shuttering which is used to form the plinths 15. The shuttering comprises two pairs of spaced parallel upstanding walls 20. Each wall as best seen in Figs. 7, 9 and 10, is formed by two L-section members which have respective ones of their limbs 21a, 21b overlapping to form said wall which defines a side wall of one plinth. The other limbs extend away from the plinth defining zone. The amount of overlap is adjustable to vary the depth of plinth available.

The two pairs of walls 20 are spaced by a framework 23 which is, as best seen in Fig. 10, tied down by means of a threaded rod 14 which engages an anchor pin 14a set in the bed on which reinforcing bars 85 for the plinths are laid. Thus the shuttering is firmly located on the bed.

Referring particularly to Figs. 6, 8 and 9, the upper of the two limbs 22 of each of the two L-section members which are on the outside of the shuttering has connected thereto a

plurality of brackets of two different types: single brackets 24 and double brackets 25. Each bracket on one outer L-section member has a corresponding bracket on the other outer L-section member which lies on a common line therewith which is normal to the length of the L-section members. The brackets 24, 25 are coloured alternately white and orange. The orange brackets are spaced apart by 750mm and the white brackets are spaced apart by 600mm. Where other clamp spacings are used the spacing of the brackets is altered accordingly. The double brackets 25 are necessary where the required location for an orange bracket and for a white bracket substantially coincide.

The single brackets 24, as in Figs. 8 and 9, comprise two L-section plates 24a, 24b, one plate, 24a, being fixed, at one end of one limb, to the L-section member. The other plate 24b has one vertical limb sliding engagement with the corresponding limb of the fixed plate 24a, with the other limb carrying an adjusting screw 86 which bears on the corresponding limb of the fixed plate 24a. The vertical limb of the moveable plate 24b carries two studs 26 which guide the moveable plate 24b in vertical sliding movement relatively to the fixed plate 24a. The upper edge of the moving plate 24b carries two spaced pins 27, see Fig. 8.

The double brackets 25 have a single fixed L-shaped plate 25a and two sliding L-shaped plates 25b each carrying a single pin 27. Their length is twice that of the single brackets 24 and the spacing of the pins 27 is double that of the pins of the single brackets 24.

Referring next to Figs. 5, 7, 8 and 9 in particular, a bar 30 for holding the shoulders 16 of the clamps comprises a central section 31 of T-section with the bar of the T lowermost. Two end sections 32, are connected to the central section 31, one at each end. Each end section 32 is of T-section but the section is inclined relatively to the central section 31 at a grade of 1 in 20. The overall length of the bar 30 is greater than the gauge of the track.

As best seen in Fig. 9, each end section 32 has two shoulder carriers 33 depending therefrom. Each shoulder carrier comprises two parallel spaced plates 34 (see Fig. 5) depending from the edges of the bar of the T-section, having corresponding holes 35 therein and separated by a rod 36. The undersurface of the end section along the part thereof bounded by the plates 34, has a neoprene block 87 bonded thereto. The two shoulder carriers 33 are spaced on either side of an imaginary line I (Fig. 9), the two imaginary lines of the two end sections corresponding to the desired positions of the centre lines of the two rails relatively to one another. The shoulder carriers 33 and the inclined end sections

32 are so arranged that shoulders 16 held by the carrier will, when set in concrete, have such an orientation and position relatively to one another that rails clamped by use of the shoulders will have a desired relative cant and gauge therebetween.

Each end section 32 also includes four rectangular blocks 37, two on either side of the vertical limb of the end section 32. The blocks 37 extend from the surface of the limb and are arranged tangentially to an imaginary circle whose centre C (Fig. 9) is the desired position of the levelling point L (Figs. 3 and 4) of the rail to be clamped by the shoulders. This position takes account of the required rail gauge. The use of these blocks 37 will be described hereinafter.

The bar 30 is fixed relatively to the shuttering by a bar clamp 80 (see Figs. 8 and 9) comprising an inverted U-shaped member having hooked ends 81 and carrying between its arms a screw 82 rotatable by a handle 83. The hooked ends 81 engage in holes 84 in the horizontal flange of the upper L-section member and the lower end of the screw 82 clamps against the bar 30.

Referring next to Figs. 11 to 14, there is shown an offset alignment device 40 which comprises a frame including two parallel guides 41 which carry between them two base plates 42a, 42b for sliding movement relatively therealong. The first base plate 42a carries a chequered target 43 (Figs. 11 and 13) which lies in a plane parallel to the direction of movement of the base plate 42a. The second base plate 42b has two parallel but spaced semicircular mounting plates 44 (Fig. 14) depending therefrom and defining between them a slot which is co-planar with the plane of the target 43. The radius of the semicircles is the same as the radius of the circle to which the blocks 37 on the bar 30 are tangents. The upper surface of the second base plate 42b carries a circular spirit level 88. Both base plates can be clamped relatively to the frame by wing bolts 45 and carry respective reference lines 46a, 46b which register against gradations of two parallel scales 47 carried on the frame and extending parallel to the direction of sliding of the base plates 42a, 42b.

At one end of the frame is a shaft 48 (see Figs. 11 and 12) having a locating foot 49 and mounted for sliding movement relatively to the frame against the action of a spring 50. The shaft 48 can be locked in a particular axial position relatively to the frame by means of a pivoted lever 51 having an eccentric 52 which bears against the shaft 48.

Referring next to Figs. 15 to 17, there is shown a levelling device 60 which comprises a foot 61 which slidably receives a wooden rule 62. The rule has gradations marked therealong which register with gradations on a rule 63 mounted on the foot 61. The lower

end of the foot 61 is flat and the foot 61 includes a clamp 64 (see Fig. 16) by which the wooden rule 62 can be clamped relatively to the foot 61.

Referring particularly to Figs. 15 and 17, a target 65 is slidably mounted on the rule 62, the target 65 being lockable in a set position after movement along the rule 62 as a result of engagement between a locking wedge 66 (Fig. 17) and the rule 62. A leaf spring 89 holds the target 65 against free sliding movement relatively to the rule 62.

Referring next to Fig. 18, there is shown a check indicator 70 which is used in a manner described hereinafter. The check indicator 70 comprises a pair of parallel but spaced sectors 71 of a circle whose radius is the radius of the circle to which the blocks 37 are tangentially arranged. A screw 72 is threadedly engaged with one sector 71 and can be screwed into the slot between the sectors 71. A staff 73 having alternate bands of black and white paint extends from the apex of the sectors along a line which is the bisector of the angle of the sectors.

Referring next to Fig. 19, there is shown a levelling centre 74 which comprises two parallel spaced sectors 75 whose radius is the radius of the circle to which the blocks 37 are tangentially arranged. The use of this centre is described hereinafter.

In use, the shuttering is set out on the concrete base 13 (Fig. 1) by use of shutter setting out points (SOP's Figs. 1 and 2). These are derived by marking the centre line of the track at two successive monuments and then pulling off a string line from which shutter SOP's can be set out as predetermined offsets from the string line. The shuttering is in 3m lengths and so shutter SOP's are marked at 3m intervals along the concrete base. The centre line of the track at the monuments is derived by adding to a horizontal dimension given at a monument, half the track gauge and an additional horizontal dimension derived from the amount of any superelevation required in the track.

Marks provided at the ends of the shuttering allow the shuttering to be aligned with the shutter SOP's. The shuttering is tied to the concrete base by means of the threaded rods 14. Thus the shuttering is fixed in position.

Next, four shoulders 16 are fitted to a bar 30, one shoulder being held in each shoulder carrier 33 by a pin passing through the carrier holes 35 and through the shoulder hole 18. The pins force the shoulders 16 against the neoprene blocks 87 and against the rod 36 to locate the shoulder 16 rigidly relatively to the bar 30. Thus the shoulders are positioned to give a rail clamped thereby a required cant and gauge relatively to one another.

The bar 30 is then ready to be placed on one of the pairs of brackets 24, 25 on the shuttering. If the track is on a horizontal curve

of less than 600m a pair of white brackets 24 or 25 will be used; for other track a pair of orange brackets 24 or 25 will be used.

- For each bracket location there will be required level measurements and an offset measurement for the rails at that location produced for example, by a computer programme, as described above. With the dimensions of the bar being known, these can easily be converted into level measurements and an offset measurement for fixed points associated with the bar 30 at each location.

- The level measurements are given as a distance between the level datum and the horizontal limb of the slidable plate 24b of each bracket 24, 25. These are then levelled in the following manner before the bar 30 is placed on the brackets. The target 65 of the levelling device 60 is set at a height corresponding to this level measurement and the foot 61 is stood on the horizontal limb. The adjusting screw is then used to raise or lower the plate 24b until the target coincides with a line of sight through a levelling instrument and extending along the datum level. Since there is a separate level measurement for each rail, the exercise is carried out on both brackets to adjust the plates 24b to required levels.

- The bar 30 is then placed on the levelled brackets 24, 25 with the pairs of shoulders located between respective pairs of walls 20 of the shuttering. The bar 30 is prevented from moving in a direction normal to its length by the pins 27.

- The alignment measurement is given as an offset distance between a tangent line set relatively to the monuments and the inside face of the reference rail. For aligning the bar use is made of the offset alignment device 40 of Figs. 11 to 14. The target 43 is positioned relatively to the second base plate 42b at a distance corresponding to the alignment measurement by use of the respective reference lines 46a, 46b and the rules 47.

- Two mounting plates 44 are then placed over the bar 30 so that the curved ends of the plates 44 rest on the blocks 37. Thus the centres of the mounting plates 44 coincide with the levelling point of the rail to be clamped by use of the associated shoulders 16. The offset between the reference line 46b and this centre line is required because the offset measurement is to the inside face of the reference rail.

- The device 40 is then made horizontally by use of the spirit level 88 and the device 40 is fixed in this position by engagement of the shaft 48 with the bar 30 and by clamping of the shaft 48 when the device is horizontal.

- The bar 30 and device 40 are then slid together in a direction along the length of the bar until the target 43 coincides with a line of sight through a theodolite set-up along the tangent line. When coincidence is reached, the bar 30 is clamped to the shuttering by the

bar clamps 80 whose hooked ends engage in holes 84 in the shuttering (Fig. 5) and whose screw 82 engages the bar 30.

- A check is then made on the level of the clamped bar 30 using the levelling centre 74 of Fig. 19. The sectors 75 of the levelling centre 74 are placed on both sets of blocks 37 on the bar 30 one after the other. In this position, the apices of the sectors 75 should be at the levelling point of the rail to be secured by the associated shoulders 16. This can be verified by taking a check level on the apices of the sectors 75. If the level is found to be incorrect, the associated clamp 80 can be loosened and the brackets 24, 25 adjusted until the level is corrected. The clamp 80 is then re-tightened.

- A check is also made on the alignment on horizontal curves. For this use is made of the check indicator 70 (Fig. 18). The sectors 71 of the check indicator 70 are placed on one of the set of blocks 37 of the bar 30 and the shaft 73 is then plumbed until it is vertical. The screw 72 is then tightened to clamp the check indicator 70 in this position. Check indicators 70 are correspondingly arranged on preceding and succeeding bars 30 and a visual sighting along the staffs 73 will show whether there is conformity with the horizontal curve.

- On straight sections, alignment can be checked by pulling a string line over the tops of a plurality of bars 30 and checking the line against saw kerfs (not shown) cut into the top of the bars 30 at defined points.

- Once these settings and checks have been completed for all the bars associated with the shuttering, concreting can commence. Wet concrete is carefully poured or shovelled into the shuttering and vibrators are used to compact the concrete. The upper surface is screeded-off using screed boards of precise dimensions to give a required depth of plinth. This depth is ensured by using the upper limbs 22 of the L-shaped members forming the shuttering walls 20 as guides for the screed boards. The concrete is smoothed around the shoulders 16 to the required level.

- Once the concrete has set, the pins are removed from the bars 30 to release the bars 30 from the shoulders 16. The shuttering is released from the reinforcing bars and the shuttering and bars 30 are removed. After filling and cleaning operations have been carried out the rails are laid on the plinths on a resilient strip extending between the pairs of shoulders 16 and are clamped in position by spring clips 19 (see Figs. 3 and 4). The rails will be located in the required predetermined orientation and position both relatively to one another and relatively to the datum points.

- It will be appreciated that by variation of the construction of the bar 30, other required relative cants and gauges between rails can be accommodated as can other types of rail

xing devices.

The shuttering described above with reference to the drawings is for use in a tunnel. It will be appreciated that other shuttering arrangements may be used with the bar 30, the shuttering forming bases of different cross-

5 sections for, for example, above ground track.

CLAIMS

10 1. A method of setting out a railway track of the kind referred to and comprising the steps of erecting shuttering to define a length of the cast concrete rail base, mounting two clamp supports, one for each rail, on a bar so
15 that the clamp supports are held by the bar in the orientation and position relatively to one another necessary to give to the two rails to be clamped thereby a required orientation and position relatively to one another when se-
20 cured on the base, placing the bar on adjustable mountings which locate the clamp supports adjacent a required final position of the clamp supports in the base, adjusting the position of the bar relatively to the horizontal datum and the vertical datum until the bar,
25 and thus the clamp supports mounted thereon, have the orientation and position necessary to give to the two rails to be clamped by the clamp supports a required orientation and position relatively to the hori-
30 zontal datum and the vertical datum, forming the concrete rail base by filling the shuttering with concrete, the concrete surrounding a part of the clamp supports to hold the clamp supports in their required orientation and posi-
35 tion, so that, after the concrete has set, the rails can be fixed to the base by the clips of the clamps to locate the rails on the base in said required orientation and position both
40 relatively to one another and relatively to the horizontal datum and vertical datum.

2. A method according to claim 1 wherein the step of placing the bar on the adjustable mountings fixes the spacing of the clamp
45 supports from the next adjacent clamp supports along the length of the track.

3. A method according to claim 2 wherein the step of adjusting the position of the bar by use of the adjustable mountings comprises
50 movement of the bar in a vertical plane which is normal to the length of the track and which includes both clamp supports.

4. A method according to claim 2 or claim 3 wherein the step of adjusting the position of
55 the bar comprises lifting or lowering one or both ends of the bar and for moving the bar laterally in the direction of the length of the bar.

5. A method according to any one of
60 claims 1 to 4 wherein the step of adjusting the position of the bar comprises adjusting the position of the bar in a vertical direction to a predetermined distance from the vertical da-
65 tum and then adjusting the horizontal distance of the bar to a predetermined offset distance

from a horizontal datum represented by a tangent line.

6. A method according to any one of
70 claims 1 to 5 and further comprising position- ing on the shuttering a plurality of spaced bars carrying clamp supports before filling the shuttering with concrete.

7. Apparatus for setting out railway track of the kind referred to and comprising shutter-
75 ing which defines a length of the cast con- crete rail base, a bar for holding two clamp supports in the orientation and position rela- tively to one another necessary to give to the two rails to be clamped thereby a required
80 orientation and position relatively to one another when secured on the base by the clamp supports, adjustable mountings on which the bar is placed to locate the clamp supports adjacent the desired final position of
85 the clamp supports in the base, the adjustable mountings being adjustable to position the bar relatively to the horizontal datum and the vertical datum until the clamp supports have the orientation and position necessary to give
90 to the two rails to be clamped by the clamp supports a required orientation and position relatively to the horizontal datum and the vertical datum, the filling of the shuttering with concrete forming the base and surround-
95 ing part of the clamp supports with concrete to hold the clamp supports in their required orientation and position, so that rails can be fixed to the base, when set, by clips engaging the clamp supports and the rails, the rails
100 then having the required orientation and posi- tion both relatively to one another and rela- tively to the horizontal datum and the vertical datum.

8. Apparatus according to claim 7 wherein
105 the bar holds the clamp supports such that rails clamped using the clamp supports are spaced, between reference points on the rails, by a distance which is the gauge of the track and such that said rails have any required
110 cant towards one another.

9. Apparatus according to claim 7 or claim 8 and in which each clamp support comprises a pair of shoulders, each shoulder having a hole for a clip and a foot for fixing
115 the shoulder in the base, wherein the bar includes two pairs of spaced shoulder carriers, each shoulder carrier including two spaced registering holes between which the hole of a shoulder is located in register with said holes
120 of the shoulder carrier, a pin passing through said holes to hold the shoulder on the bar in the required orientation and position.

10. Apparatus according to any one of
125 claims 7 to 9 wherein the adjustable mount- ings are so arranged relatively to the shutter- ing that they fix the spacing of the clamp supports from the next adjacent clamp sup- ports along the length of the track.

11. Apparatus according to claim 10
130 wherein the adjustable mountings include a

ing devices.

The shuttering described above with reference to the drawings is for use in a tunnel. It will be appreciated that other shuttering arrangements may be used with the bar 30, the

- 5 shuttering forming bases of different cross-sections for, for example, above ground track.

CLAIMS

- 10 1. A method of setting out a railway track of the kind referred to and comprising the steps of erecting shuttering to define a length of the cast concrete rail base, mounting two clamp supports, one for each rail, on a bar so
15 that the clamp supports are held by the bar in the orientation and position relatively to one another necessary to give to the two rails to be clamped thereby a required orientation and position relatively to one another when secured on the base, placing the bar on adjustable mountings which locate the clamp supports adjacent a required final position of the clamp supports in the base, adjusting the position of the bar relatively to the horizontal datum and the vertical datum until the bar,
20 and thus the clamp supports mounted thereon, have the orientation and position necessary to give to the two rails to be clamped by the clamp supports a required orientation and position relatively to the horizontal datum and the vertical datum, forming the concrete rail base by filling the shuttering with concrete, the concrete surrounding a part of the clamp supports to hold the clamp
25 supports in their required orientation and position, so that, after the concrete has set, the rails can be fixed to the base by the clips of the clamps to locate the rails on the base in said required orientation and position both relatively to one another and relatively to the horizontal datum and vertical datum.

2. A method according to claim 1 wherein the step of placing the bar on the adjustable mountings fixes the spacing of the clamp
30 supports from the next adjacent clamp supports along the length of the track.

3. A method according to claim 2 wherein the step of adjusting the position of the bar by use of the adjustable mountings comprises
35 movement of the bar in a vertical plane which is normal to the length of the track and which includes both clamp supports.

4. A method according to claim 2 or claim 3 wherein the step of adjusting the position of the bar comprises lifting or lowering one or both ends of the bar and for moving the bar laterally in the direction of the length of the bar.

5. A method according to any one of
40 claims 1 to 4 wherein the step of adjusting the position of the bar comprises adjusting the position of the bar in a vertical direction to a predetermined distance from the vertical datum and then adjusting the horizontal distance of the bar to a predetermined offset distance

from a horizontal datum represented by a tangent line.

6. A method according to any one of claims 1 to 5 and further comprising positioning on the shuttering a plurality of spaced bars carrying clamp supports before filling the shuttering with concrete.

7. Apparatus for setting out railway track of the kind referred to and comprising shuttering which defines a length of the cast concrete rail base, a bar for holding two clamp supports in the orientation and position relatively to one another necessary to give to the two rails to be clamped thereby a required orientation and position relatively to one another when secured on the base by the clamp supports, adjustable mountings on which the bar is placed to locate the clamp supports adjacent the desired final position of the clamp supports in the base, the adjustable mountings being adjustable to position the bar relatively to the horizontal datum and the vertical datum until the clamp supports have the orientation and position necessary to give to the two rails to be clamped by the clamp supports a required orientation and position relatively to the horizontal datum and the vertical datum, the filling of the shuttering with concrete forming the base and surrounding part of the clamp supports with concrete to hold the clamp supports in their required orientation and position, so that rails can be fixed to the base, when set, by clips engaging the clamp supports and the rails, the rails then having the required orientation and position both relatively to one another and relatively to the horizontal datum and the vertical datum.

8. Apparatus according to claim 7 wherein the bar holds the clamp supports such that rails clamped using the clamp supports are spaced, between reference points on the rails, by a distance which is the gauge of the track and such that said rails have any required cant towards one another.

9. Apparatus according to claim 7 or claim 8 and in which each clamp support comprises a pair of shoulders, each shoulder having a hole for a clip and a foot for fixing the shoulder in the base, wherein the bar includes two pairs of spaced shoulder carriers, each shoulder carrier including two spaced registering holes between which the hole of a shoulder is located in register with said holes of the shoulder carrier, a pin passing through said holes to hold the shoulder on the bar in the required orientation and position.

10. Apparatus according to any one of claims 7 to 9 wherein the adjustable mountings are so arranged relatively to the shuttering that they fix the spacing of the clamp supports from the next adjacent clamp supports along the length of the track.

11. Apparatus according to claim 10 wherein the adjustable mountings include a



pair of laterally spaced moveable surfaces on which, in use, the bar rests, each surface having an associated lug or lugs upstanding therefrom for preventing movement of the bar in a direction along the length of the rails.

12. Apparatus according to claim 10 or claim 11 wherein each surface is formed on a plate which is arranged in a vertical or substantially vertical plane and which is adjustable in said vertical or substantially vertical plane for raising or lowering an associated end of the bar in a vertical plane normal to the length of the track at the position of the bar.

13. Apparatus according to any one of claims 10 to 12 wherein the bar is slideable over said surfaces in the direction of the length thereof for adjusting the position of the clamp supports and wherein a securing device is provided to fix the position of the bar relatively to the adjustable mountings when the final position of the bar has been reached thereby to prevent movement of the bar during concreting.

14. Apparatus according to any one of claims 7 to 13 wherein the adjustable mountings have a locating point moveable therewith, the locating point providing a rest for a foot of a levelling staff of the apparatus which has an adjustable target thereon, the target, in use, being set at a height which corresponds to a required vertical distance of the locating point, and thus of the clamp supports and rail, from the vertical datum, the position of the adjustable mountings being adjusted until the target is on said vertical datum.

15. Apparatus according to claims 7 to 14 wherein the adjustable mountings are carried on the shuttering.

16. Apparatus according to any one of claims 7 to 15 wherein the bar includes a locating point for mounting on the bar an offset device of the apparatus, the offset device having a target thereon which is adjustable in a horizontal direction, the target, in use being set at a horizontal distance from the locating point on the bar which corresponds to a required offset of the rails from a horizontal datum in the form of a tangent line, the bar being moved until the target lies on the tangent line.

17. A method of setting out railway track of the kind referred to, substantially as hereinbefore described with reference to the accompanying drawings.

18. Apparatus for setting out railway track of the kind referred to, substantially as hereinbefore described with reference to the accompanying drawings.