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RAILWAY TRACK SUPPORT

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Filed Nov. 10, 1964, Ser. No. 410,153

Claims priority, application France, Nov. 14, 1963,
953,717

8 Claims. (Cl. 238—117)

The present invention relates to railway track supports and in particular to concrete track supports.

Apart from single-piece ties or sleepers—whose shape, dimensions and conditions of use in the railway track are derived from wooden ties or sleepers—concrete track supports in general use are of two different types.

(a) Ties or sleepers of the composite type composed of a steel girder embedded in reinforced concrete at both ends so as to form a support unit under each rail, the girder performing the function of the main reinforcement of each of the concrete blocks and a spacer member so as to maintain the relative inclination of, and appropriate width between, the rails. The most advanced composite tie is that constructed by the applicant and described in the French Patent No. 984,615, filed on Apr. 1, 1949.

(b) Longitudinal ties or slabs of concrete of rectangular-sided shape which extend longitudinally under each of the rails of the track in the direction of their largest dimension. The rails are maintained in their relative position by transverse metal spacer members which are disposed in the space between the successive slabs and are independent of the latter.

These two types of concrete track supports each have their advantages and drawbacks.

As concerns the composite tie the following advantages encourage its use:

The steel stay or spacer member, which is both flexible and strong, is not adversely affected by pressure applied on the ballast on the axis of the track, whereas this pressure is usually fatal to ties in one piece, even if they are of the pre-stressed type. The blocks are robust and their dimensions are limited in both length and width to a moderate value, whereas their thickness is relatively great so that they offer good resistance to the dynamic forces that each rail transmits thereto in the region of their centre; however the total weight of the composite tie remains reasonable owing to the absence of concrete in the central part. The steel of the stay or spacer member embedded in the concrete of the two blocks participates to a great extent in the resistance thereof to bending, shear and fatigue stresses, and it is also employed for anchoring the rail-fixing bolts, as is a metal tie.

However, the composite tie has the following drawbacks:

The dimensions of the reinforced concrete blocks, and in particular the length thereof, cannot be increased without inconvenience and without danger of adversely affecting the strength. As the useful surface area of the blocks is thus limited these blocks have a tendency to sink into the ballast quicker than wooden ties which are supported throughout their length. Further, the composite ties—as all other ties—form for the rail discontinuous and equispaced supports so that upon the passage of heavy axles the rail bends between the ties and sets up oscillations which result in fatigue of the rolling material and of the track assembly.

These drawbacks can be remedied by reducing the spacing between the ties; however, bringing the ties closer together would unfortunately increase the cost price of the track to an excessive degree since each rail support has at least one pair of highly stressed elastically yieldable fasteners which are in normal use on main lines but ex-

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pensive. Further, ties placed too close together can no longer be correctly packed with ballast and become unstable.

Concrete longitudinal ties or slabs have the main advantage of distributing over a very large area of ballast the loads transmitted by the rails to each support, since each longitudinal tie or element has at least two supports for the rail. Bending and fatigue stresses in respect of the rail are consequently reduced and the stability of the longitudinal ties under rolling loads is remarkable since the unit pressure under the large-area longitudinal ties is much less than under the smaller blocks of composite ties.

On the other hand, the longitudinal ties have the following drawbacks:

As opposed to composite ties, the steel spacer member interconnecting the two rails does not participate in the resistance of the longitudinal ties themselves. These ties therefore have a tendency to break longitudinally under the rails. If pre-stressing is employed so as to increase the dimensions and useful area of the longitudinal ties, it is practically essential for this reason to pre-stress in two directions, namely in the directions both parallel and perpendicular to the rail and this is a costly complication.

Further, the longer the longitudinal ties the more difficult it is to pack in an effective and uniform manner the ballast on which these ties rest, and experience has shown that this could again result in fractures.

Although the track supported by longitudinal ties offers a satisfactory resistance to transverse displacement under the effect of lateral dynamic forces of the vehicles, the resistance to the longitudinal forces of rail creep or expansion is very low and the track supported by longitudinal ties behaves in the manner of a sledge.

The object of the present invention is to provide a new concrete track support which is so designed as to combine the advantages of the aforementioned two types of support while avoiding their drawbacks.

The invention provides for this purpose a track support comprising two concrete blocks interconnected by a steel stay, wherein each block has in plan approximately the shape of an equal-sided quadrilateral, one of the diagonals of said quadrilateral being in the longitudinal plane of symmetry of the stay and the other diagonal being parallel to the longitudinal axis of the rail support surface on the block.

Consequently, in the support according to the invention the support surface for the rail is much longer than that of composite ties and is somewhat similar to that obtained with the longitudinal ties or slabs, since this length is the length of one of the diagonals of the blocks. Consequently, this support can be named a transverse-longitudinal tie and it will be seen hereinafter that it does indeed combine the advantages of the aforementioned two types of support.

In practice the corner of each block adjacent the stay or spacer member is advantageously truncated so as to form a face having a width at least equal to that of the stay, the other three corners being radiused or rounded so as to preclude crumbling or spalling of the concrete.

The diagonal parallel to the longitudinal axis of the rail support surface on the underlying block can coincide with said axis or be slightly outwardly offset therefrom.

Bearing in mind the length of this diagonal, it is possible to provide on each block two support zones for the flange of the rail which are located symmetrically relative to the axis of the spacer member and spaced apart a distance equal to or less than the space between the axes of the ties of a conventional track, namely 75 cm. These support zones can be embodied on the surface of each block by two sole-plates or two elastically yieldable pads fixed to the block in an appropriate manner.

The fastening of the rail on each block can be achieved by two pairs of fasteners each pair being placed in one of the support zones. However, it is more advantageous to provide a single pair of fasteners located on the diagonal intersecting the longitudinal plane of symmetry of the stay.

It will be understood that the concrete of the blocks is reinforced by reinforcements in the conventional manner. These reinforcements can be pre-stressed or post-stressed so as to achieve a pre-stressing of the concrete in the directions of the two diagonals, or at least in the direction of the diagonal which is parallel to the axis of the rail support surface.

Further features and advantages of the invention will be apparent from the ensuing description with reference to the accompanying drawings to which the invention is in no way limited.

In the drawings:

FIG. 1 is a perspective view of one embodiment of a track support according to the invention and,

FIG. 2 is a plan view of a railway track laid on the supports shown in FIG. 1.

In the illustrated embodiment, the track support according to the invention comprises two blocks 1 of reinforced concrete which are interconnected by a spacer member or stay 2 of steel which is embedded in the blocks 1 at both ends. If desired, in the part thereof between the blocks, the stay 2 can be covered with concrete.

Each block 1 has in plan approximately the shape of an equal-sided quadrilateral ABCD, such as a square or diamond or lozenge (FIG. 2). This quadrilateral is so oriented that one of its diagonals, AC, is located in the longitudinal plane of symmetry of the stay 2 indicated by the line X—X in FIG. 2, the other diagonal BD, being parallel to the longitudinal axis of the bearing surface on the blocks of the rail *r*, namely the rail axis Y—Y. The diagonal BD can coincide with the axis of the rail or, better still, be as shown, slightly outwardly offset relative to this axis. When the quadrilateral ABCD has a diamond shape the angles A and C are preferably greater than 90° so as to increase the length of the diagonal CD.

For practical reasons, the corners A, B and D are rounded whereas at corner C adjacent the stay 2 the block 1 is truncated. This provides a flat face 3 whose width is at least equal to that of the stay 2.

Disposed on the upper face of each block 1 are two metal sole-plates or two elastically yieldable pads 4 which are secured in any appropriate manner to this face and embody two bearing means on the block for the rail *r*.

The axis of the bearing means 4 coincides with the axis of the rail *r* which in turn is coincident with the diagonal BD, or parallel to the latter should the diagonal BD be slightly offset, as mentioned hereinbefore. Further, the two support means or zones are symmetrical relative to the diagonal AC, the spacing thereof being of the order of at least 75 cm.

To secure the rail on each block, rail fasteners *a*, preferably of the doubly elastic type, can be secured by bolts *b* or other clamping-down means, one pair of fasteners being provided for each support zone and disposed on the transverse axis of this zone. However, it is advantageous and cheaper to provide only a single pair of fasteners *a* for each block these fasteners being located on the diagonal AC, namely in the longitudinal plane of symmetry X—X of the stay 2. The position of the fasteners is determined on each block by the apertures 5 for the passage of the bolts *b*; these apertures can be formed in any suitable manner when moulding the support. There could also be provided on the surface of each block and extending in a direction perpendicular to the diagonal AC, grooves or recesses 6 adapted to receive the end *c* of the fasteners *a* which is remote from the rail, or alternatively an inserted element provided with a recess for this end *c*.

FIG. 2 shows a railway track incorporating a support

according to the invention. It can be seen that the blocks 1 of adjacent supports can be placed almost in corner-to-corner relation with their diagonals BD in alignment so as to form an almost continuous support surface for the rail. Notwithstanding the nearness of the supports, the tamping or the shovel-packing of the ballast under each block is easy. This can be effected on the four sides of each block (in the direction of the arrows *f*) which are spaced from the sides of the adjacent blocks owing to the very shape and disposition of the blocks.

It will be clear from the foregoing that the invention remedies the drawbacks of the two types of supports, namely composite transverse ties and longitudinal ties, which it tends to replace, while retaining the essential advantages thereof to which are added further advantages peculiar to the support according to the invention.

The metal reinforcement afforded by the stay greatly contributes to the prevention of cracks in a direction parallel to the rail. This function is not performed by the independent spacer members of conventional longitudinal ties. Thus the advantage of the composite tie over the longitudinal tie has been retained. In the case where the reinforcement parallel to the rail affords a pre-stressing, the compression of the concrete resulting therefrom exerts along the stay a stress which according to Poisson's coefficient, resists the cracking of the concrete in this orthogonal direction.

It is possible without inconvenience as shown hereinbefore, to place the supports according to the invention very close to each other in the track without adversely affecting the tamping of the ballast. Consequently, the effective area of the bearing surfaces on the ballast per metre of track will be much greater than that of composite ties. However, this effective area will be slightly less than that of longitudinal ties but this drawback, if it can be so termed, is compensated by the ease of tamping or shovel-packing which results in a more even distribution of the pressures on the ballast.

The original disposition of the two separate supports of the rail with their diagonals parallel to the latter is that which results in the minimum bending moment in the concrete. Further, this arrangement offers the double advantage of reducing the bending moment corresponding to the resultant of the support reactions on the ballast, whereas the section of the concrete is maximum in the zone subjected to maximum bending moments. As the dimensions of the blocks are, moreover, limited to a reasonable value corresponding to solely two supports of the rail, the concrete is under much less stress than in known longitudinal ties which have in plan the shape of a rectangle whose sides are parallel and perpendicular to the rail and whose length is, moreover, always distinctly greater than one metre.

From the point of view of cost, there is easily obtained an effective support area on the ballast per metre of track which is nearly that of the track laid on longitudinal ties and in any case greatly exceeds that of the track on composite ties, but as the concrete is subjected to less stress than in longitudinal ties there is a saving in the weight of the materials employed, namely concrete and steel, and it is even possible to dispense with the pre-stressing.

The original disposition comprising two separate supports of the rail with a single pair of fasteners, which is possible owing to the fact that the blocks can be placed almost in adjoining corner-to-corner relation in the track and that the bending of the rail is considerably less between the supports than in a conventional track also results in a very great saving. The modern track laid on concrete indeed requires costly doubly elastic fasteners. The invention enables the number of these fasteners to be reduced by about one third.

A track equipped with long welded rails and laid on the supports according to the invention is much stronger than a track on transverse ties or a track on longitudinal ties in both the longitudinal and transverse directions.

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Indeed, regardless of the direction of the forces exerted on the track, all the lateral faces and edges of the blocks, which are placed in diagonal relation, wedge against the ballast both within the track and in the lateral terms.

The relative remoteness of the two rail support zones on each block permits considerably increasing the tailing-in moment of the rail on the supports, that is, the transverse stiffness of the chassis of the track, and this contributes to the reliability of the welded track, which is subjected to very rapid traffic, while reducing the maintenance costs of the lining.

Although specific embodiments of the invention have been described, many modifications and changes may be made therein without departing from the scope of the invention as defined in the appended claims.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:

1. Railway track support comprising in combination two rigid concrete blocks and a steel stay having end portions completely embedded in and interconnecting the blocks, wherein each block has in plan approximately the shape of an equal-sided quadrilateral, one of the diagonals of said quadrilateral being in the longitudinal plane of symmetry of the stay and the other diagonal being perpendicular to said one of the diagonals, two bearing means, symmetrically disposed relative to the longitudinal plane of symmetry of the stay on the upper face of each block for the flange of the corresponding rail, each bearing means having a top face upwardly projecting from the upper face of the block.

2. Railway track support as claimed in claim 1, wherein the corner of each block adjacent the stay is truncated in plan so as to provide a face whose width is at least equal to the width of the stay, and three other corners of the block being rounded in plan.

3. Railway track support as claimed in claim 1, wherein said quadrilateral is a diamond the major diagonal of which is said other diagonal.

4. Railway track support as claimed in claim 1, wherein said bearing means are spaced apart substantially 75 cm.

5. Railway track support as claimed in claim 1, wherein each of said bearing means comprises a sole-plate fixed to the upper face of each block.

6. Railway track support as claimed in claim 1, wherein each of said bearing means comprises an elastically yieldable pad fixed to the upper face of each block.

7. Railway track support comprising in combination two rigid concrete blocks and a steel stay having end portions completely embedded in and interconnecting the blocks, wherein each block has in plan approximately the shape of an equal-sided quadrilateral, one of the diagonals of said quadrilateral being in the longitudinal plane of symmetry of the stay and the other diagonal

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being perpendicular to said one of the diagonals, two bearing means symmetrically disposed relative to the longitudinal plane of symmetry of the stay on the upper face of each block for the flange of the corresponding rail, each bearing means having a top face upwardly projecting from the upper face of the block, means on the block for placing in position two rail fasteners and clamping-down means for the two fasteners, the fasteners and clamping-down means being assembled with the corresponding block in alignment on that diagonal of the block which is located in the longitudinal plane of symmetry of the stay.

8. A railway track comprising two rails and a plurality of railway track supports, each railway track support comprising in combination two rigid concrete blocks and a steel stay having end portions completely embedded in and interconnecting the blocks, wherein each block has in plan approximately the shape of an equal-sided quadrilateral, one of the diagonals of said quadrilateral being in the longitudinal plane of symmetry of the stay and the other diagonal being perpendicular to said one of the diagonals, two bearing means symmetrically disposed relative to the longitudinal plane of symmetry of the stay on the upper face of each block for the flange of the corresponding rail, each bearing means having a top face upwardly projecting from the upper face of the block, means on the block for placing in position two rail fasteners and clamping-down means for the two fasteners, the fasteners and clamping-down means being assembled with the corresponding block in alignment on that diagonal of the block which is located in the longitudinal plane of symmetry of the stay, planes containing the four sides of each block intersecting at points which substantially coincide with the points of intersection of the planes containing the four sides of the immediately adjacent blocks pertaining to the same rail.

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