July 21, 1964 L. ALSENZ ETAL 3,141,614

REINFORCED CONCRETE STRUCTURES FOR RAILWAY CROSSINGS

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FIG. 1

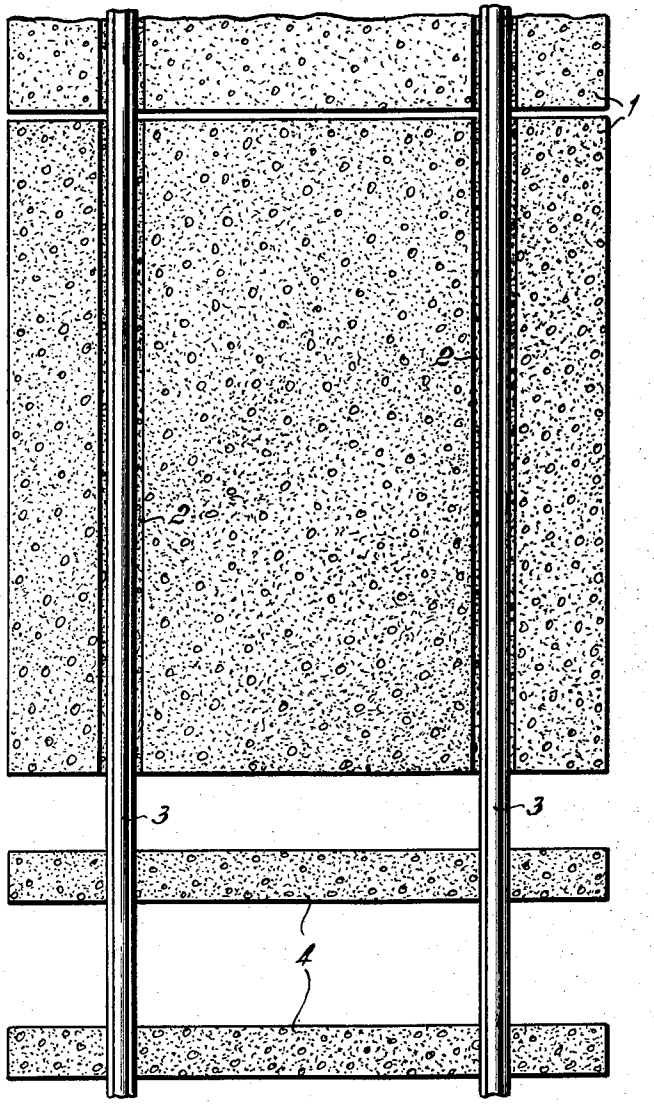

FIG. 2

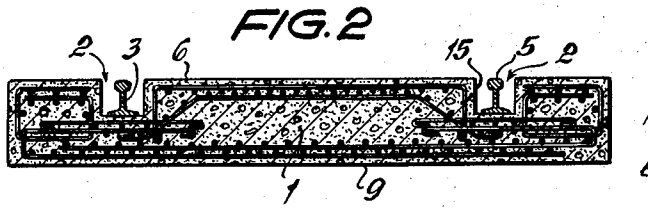

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FIG. 3

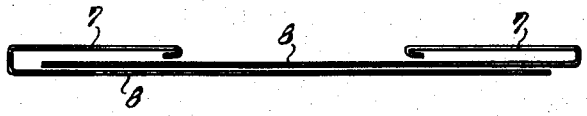


FIG. 4

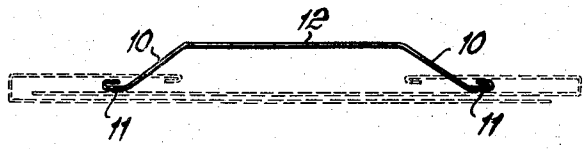


FIG. 5

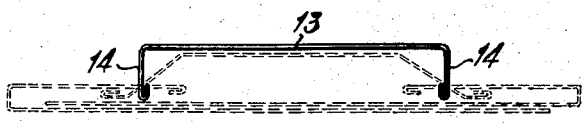


FIG. 6

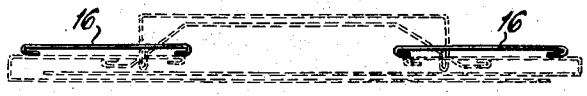
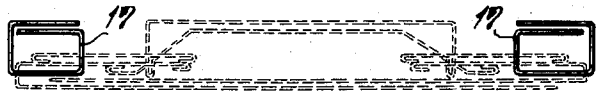


FIG. 7



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REINFORCED CONCRETE STRUCTURES FOR RAILWAY CROSSINGS

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2 Claims. (Cl. 238—8)

The present invention relates to slabs or the like constituting reinforced concrete structures for use as rail supporting panels at railway crossings.

Difficulties frequently arise when level crossings are laid over railway tracks, with both means of transport, namely, rail and road, disposed at the same level. The spaces between the individual sleepers must be filled and the crossings strengthened so that the resultant driving conditions are satisfactory both for trains and for road vehicles.

In this connection it is known to lay in a direction longitudinally of a railway track, a number of slabs, each consisting of reinforced concrete and provided with channel-like recesses extending transversely to the direction of the carriageway. The size of such slabs is such that they usually not only bridge the gauge between the rails but also extend on both sides thereof. Slabs of this kind must be reinforced according to the various stresses originating from the load of road and rail traffic and acting in different or opposite directions. The reinforcement has hitherto been effected with the aid of separate bars of round steel which are suitably bent and are interconnected by wire. Since the slabs at the tops thereof have grooves for receiving the rails, the cross-sectional area of the concrete slab is greatly reduced in said areas. Consequently the reinforcement or armouring must be strengthened at these places, the already not inconsiderable cutting, bending installing and connecting work being increased by the use of round steel as reinforcement.

The primary object of the present invention is to simplify the reinforcement of such slabs and to make the manufacture thereof more economical by using as reinforcement already known three-dimensional steel mats which, in contradistinction to incorporating separate bars, consist of bars intersecting at right angles and connected by spot welding at the place of intersection.

The longitudinal and transverse bars of such mats usually extend over the full width and length of the mats. Plane mats of this kind can be used immediately as reinforcements for flat supports such as normal ceiling boards, but not for boards or panels which have through grooves for the rails of railway lines and are alternately stressed by considerable loads, such as in the case of slabs for constructing level crossings at the junction of railway tracks and forming the subject of the present invention.

The present invention is characterised in that in the case of a reinforced concrete slab for use in providing passages for traffic at crossings between a road and a railway, the slab is reinforced in several planes by means of multiple reinforcing mats shaped to form three-dimensional structures, some of which are open and some of which are closed and consist in known manner of longitudinal and transverse bars crossing each other at right angles and interconnected by spot welding.

More specifically, the improved reinforcing structure for railroad crossing concrete slabs according to the present invention comprises essentially a combination of the following elements with the term "mat" or "mat structure" as used for the purpose of the present specification being understood to include the necessary transverse or cross bars being spot welded to the respective three-dimensional reinforcing bars or members, in the manner shown by the drawing.

(*a*) A lower reinforcement of the slab consisting of two hairpin mats having unequal shanks and with their open ends opposite each other, the longer shanks on the underside of the slab overlapping to produce a double layer reinforcement and the shorter shanks disposed above extending only over the area below the rail-receiving grooves of the slabs.

(*b*) A reinforcing mat structure in the form of a trapeze which is open on the long side and has externally downwardly-sloping sides, the ends of which are bent horizontally to form pedestals or bases, said reinforcing structure being provided in the area between said grooves in the slabs.

(*c*) An inverted U-shaped structure which is disposed in the area between said grooves and the yoke or cross piece of which forms, together with that of the trapezoidal structure, an upper reinforcement of the slab between the grooves and the corners of which assume the reinforcement for the inner edges of the rail channels or grooves.

(*d*) Narrow flat strips extending in a direction longitudinally of the rails and operating as pressure-distributing reinforcements under the rail tracks.

(*e*) Closed rectangular structures in the areas outwardly beyond the rail grooves.

The invention is more particularly described with reference to the accompanying diagrammatic drawings which illustrate one form of construction of a reinforced railroad crossing slab by way of example and in which:

FIGURE 1 is a plan view of the slabs laid side by side and without showing their steel reinforcements.

FIGURE 2 is a cross section taken on the line II—II of FIGURE 1 and showing the inlaid reinforcement of the slab.

FIGURES 3 to 7 inclusive show in cross section the sequence of the assembly of the respective individual reinforcing mat units which collectively provide the reinforcement of the present invention, the straight transverse or cross bars being omitted for greater clarity.

In the construction illustrated, FIGURE 1 shows a rail crossing in plan view which is composed of slabs **1** disposed in abutting relationship in a direction longitudinally of the railway lines. Each slab **1** includes the ground surface of several normally laid sleepers **4**. The number of slabs **1** employed depends on the width of the rail crossing and on the width of a road crossing the railway line. The slabs **1** are provided with channel-like depressions or grooves **2** which serve to receive the rails **3** of railway lines. The rails **3** are mounted on the base of the grooves **2** in known manner so that the heads **5** do not project above the upper face **6** of the slabs **1**.

The individual slabs **1** are preferably made at a time independently of their installation on the track, i.e. they are manufactured and transported as so-called prefabricated reinforced concrete units to the place of installation. However, where local conditions permit or require it, it is obviously also possible to manufacture the slabs **1** in situ.

FIGURE 2 illustrates the cross section through a track-supporting slab reinforced according to the present invention with the reinforcement of the slab **1** consisting of reinforcing mats shaped into three-dimensional structures with the straight cross or transverse bars of the mats being indicated by solid circles in the drawing.

The individual reinforcing structures, their relationship and the order of their respective incorporation are shown in FIGURES 3 to 7. In the interest of simplicity only those bars or the like elements of the mats which are bent in a particular manner to form the three dimensional mats or those bars corresponding to the cross section of the in-

dividual mat structures are shown, the cross bars extending perpendicularly to those illustrated being omitted. The reinforcing mat structures shown in full lines represent those being fitted at a particular time in the course of the operation illustrated, while the reinforcing structures shown in broken lines represent those already laid at that time.

Since the panels **1** used to make a rail crossing always have the same basic dimensions, the individual reinforcing structures can be prefabricated separately. The base is formed by reinforcing mats having predetermined dimensions, bar diameters and spaced intervals between the bars which are bent into three dimensional reinforcing structures in the above-stated manner. This avoids losses due to cutting comparatively large steel mats to size. The welding of the bars ensures an accurate space between them. The distribution of the bars within the mats may be effected in advance in accordance with static requirements, but, at the same time, so that any longitudinal or transverse bars impeding the laying of the reinforcement can be omitted. This enables the reinforcement to be installed in the manner of the assembly of prefabricate machine parts, without the necessity of the bars having to be cut through or severed.

Two mats bent into hairpin-shape reinforcing structures are used as the basic reinforcement (FIGURE 3). These two reinforcing structures are completely identical and each has a short shank **7** and a long shank **8**. They are laid in the shuttering or formwork which is prepared for the manufacture of the concrete slab **1** as a whole and which is constructed in known manner, so that the longer shanks **8** of each basic reinforcement face the bottom **9** of the slab **1** and overlap for the greater part of their length. In this manner a double-layer reinforcement is provided at the most heavily stressed region of the slabs **1**. This basic reinforcement of two hairpin-like structures has a dual function in that it constitutes the lower reinforcement for the track supporting slabs **1** and also at the same time a part of the reinforcement for the areas beneath the grooves **2** for the rails **3**.

In accordance with FIGURE 4, the next reinforcing structure is then fitted in position this taking the form of a trapezium but which is open on the longer side and is provided with outwardly sloping sides **10**. The ends of the inclined sides **10** are bent to form horizontal feet or bases **11** by which the trapezoidal reinforcing structure is set and maintained upright on the reinforcement formed from the shanks **8** of the hairpins of the basic reinforcement of FIGURE 3. The shorter side of the trapezium **12** is disposed on the surface **6** of the slab **1** and operates to absorb the stresses which occur there from the load resulting from the rails. As shown in FIGURE 2 the inclined parts **10** extend obliquely below the grooves **2** and thereby receive the thrust stresses between the portion of the slab inside the rails **3**, and the rail bearings.

An inverted and flattened U-shaped structure, a horizontal yoke or cross piece **13** of which forms, jointly with that of the trapezoidal structure, the upper reinforcement of the slab **1** between the rails, is then mounted on the reinforcing members already described as shown in FIGURE 5. Substantially perpendicularly bent edge areas **14** of the structural steel mat representing the base layer of this U-shaped structure, form the reinforcement of the side edges **15** of the grooves **2**.

Two plane narrow mat strips **16** are then applied (FIGURE 6). Each of these strips **16** rests on the shorter shank **7** of the hairpin reinforcing structures and serves, in the axial direction of the rails **3**, as a pressure distributing reinforcement under the rail grooves or channels.

Finally and in order to reinforce the areas outside the rail channels **2**, mats bent into closed rectangular reinforcing structures are used these mats being mounted from above on the already assembled reinforcement as shown in FIGURE 7.

If necessary, the ends of the mats bent to form the reinforcing structures of the present invention can be provided in known manner with hook-like bent members in order to anchor the tensile forces of the reinforcements.

If, for any particular reason, the slab **1** should not be fabricated in the position as shown in FIGURE 2, but should be turned, for example, through 180°, this change has no influence on the construction of the reinforcing structural steel mats. The sequence of the order of laying would however require to be revised. Again variation in the operation of fabricating rail supporting slabs might be desirable for example if the lower side **9** of the slab is to be made as smooth as possible. This change could be effected for example by carefully smoothing the surface of the concrete in the shuttering. It is also possible to construct the slabs in an upright state. In this event also, merely the sequence of the laying of the mat structures and their fitting one with respect to another, alone needs to be adapted to the changed position of the slab.

A further advantage of the reinforcements of rail-supporting slabs of the present invention by means of mats resides in the features that shutter tolerances or slight changes of the ground plan of the shuttering can be achieved immediately without it being necessary to change the prefabricated reinforcing structures. When the reinforcing structures are laid, they need only be displaced slightly relatively to each other, and this applies in particular to the lower reinforcement comprising the hairpin structures.

The use of structural steel mats has a further advantage in that the sorting of the individual parts required for the reinforcement as a whole can be reduced to a minimum amounting, in the case of the ground plan surface of a slab of 2.40 x 2.60 m., to only five parts.

These parts are sufficient to reinforce the entire slab with only a few quick manipulations which again can be performed by unskilled labour.

The use of reinforcing structures of constructural steel mats for slab-like concrete panels of railway level crossings, in accordance with the present invention, is not limited to the embodiment illustrated. Thus other forms or types of mats may be employed which may not only be simpler but require fewer reinforcements for each slab. In general, however, the mats of the present invention represent the optimum reinforcement by which also additional laterally acting forces can be received originating from the road traffic crossing the slabs.

In the foregoing the invention has been described with reference to a specific illustrative device. It will be evident, however, that modifications and variations, as well as the substitution of equivalent parts and elements for those shown and disclosed herein for illustration, may be made without departing from the broader scope and spirit of the invention as set forth in the appended claims. The specification and drawings are accordingly to be regarded in an illustrative rather than in a restrictive sense.

We claim:

1. In a concrete slab for use as a railroad level crossing unit having a pair of parallel grooves spaced from its outer edges and adapted for the mounting therein of the rails of a railroad track with the heads of the rails being flush with the surface of said slab, a reinforcing structure embedded in said slab comprising in combination:

(*a*) a pair of three-dimensional hairpin mat structures having unequal shanks, said structures being disposed with the surfaces formed by their longer shanks in parallel and closely spaced from the lower surface of said slab and with the surfaces formed by their shorter shanks each being close to and spaced from the bottom of one of said grooves, to form the lower reinforcement of said slab,

(*b*) a three-dimensional trapezoidal mat structure being open at the long side and having externally slop-

ing sides terminating in horizontal bases, said trapezoidal structure being disposed between said grooves with said bases located each beneath the bottom of one of said grooves,

(*c*) a three-dimensional inverted U-shaped mat structural also disposed between said grooves and having a central surface close and parallel to the central surface of said trapezoidal structure, to form therewith the upper reinforcement of said slab, said U-shaped structure having side surfaces being parallel and close to the inner sides of said grooves, and

(*d*) a pair of three-dimensional rectangular mat structures disposed each within one of the end spaces of said slab outside of said grooves.

2. In a concrete slab for use as a railroad level crossing unit having a pair of parallel grooves spaced from its outer edges and adapted for the mounting therein of the rails of a railroad track with the heads of the rails being flush with the surface of said slab, a reinforcing structure embedded in said slab comprising in combination:

(*a*) a pair of three-dimensional hairpin-shaped mat structures having unequal shanks, said structures being disposed with the surfaces formed by their longer shanks in parallel and closely spaced from the lower surface of said slab and with the surfaces formed by their shorter shanks each being close to and spaced from the bottom of one of said grooves, to form the lower reinforcement of said slab,

(*b*) a three-dimensional trapezoidal mat structure being open at the long side and having externally

sloping sides terminating in horizontal bases, said trapezoidal structure being disposed between said grooves with said bases located beneath the bottom of said grooves,

(*c*) a three-dimensional inverted U-shaped mat structure also disposed between said grooves and having a central surface close and parallel to the central surface of said trapezoidal structure, to form therewith the upper reinforcement of said slab, and said U-shaped structure having side surfaces being parallel and close to the inner sides of said grooves,

(*d*) a pair of narrow flat mat structures each disposed beneath one of said grooves and being substantially parallel to the shorter shanks of said hairpin structures, and

(*e*) a pair of three-dimensional rectangular mat structures disposed each within one of the end spaces of said slab outside of said grooves.

References Cited in the file of this patent

UNITED STATES PATENTS

1,058,163	Ekholm	Apr. 8, 1913
1,362,561	Cook	Dec. 14, 1920
1,614,405	Soulas	Jan. 11, 1927
1,784,901	Klingensmith	Dec. 16, 1930
2,520,754	Beisel	Aug. 29, 1950
2,551,500	Maney	May 1, 1951

FOREIGN PATENTS

325,316	Great Britain	Feb. 20, 1930
148,141	Sweden	Dec. 21, 1954