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(54) **Heavy tailor made railway crossing and its fabrication**

(57) The invention relates to a prefabricated railroad level-crossing, consisting of two or more prefabricated concrete slabs with grooves (2) for containing the rails (3) and tubes (6) for containing pretension ropes. In the

factory the joint between the concrete slabs is filled with cast mortar after which the pretension wires are tensioned while mortar is squeezed from the joint. Then the rails are placed after which the level-crossing is transported to its final location.

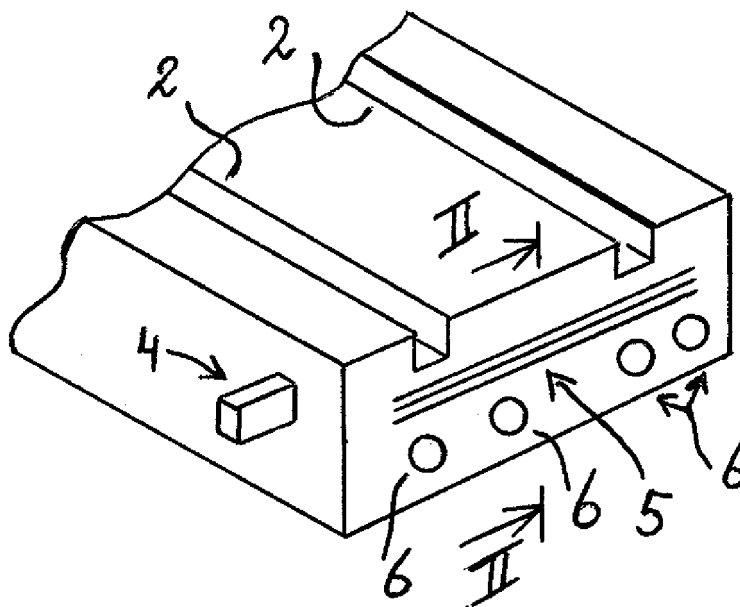


Fig. 1

Description

[0001] Known is a level-crossing that has two or more in one line placed prefabricated, reinforced concrete slabs (each up to 6 or 9 meter long) with two grooves for the inclusion of the rails. The slabs are each individually with a crane hoisted in position in the track, after which the rails are placed in the grooves and fixed and embedded in casting. To set, each concrete slab is equipped with four adjustable feet, one at each corner. Each foot includes a below the bottom of the concrete slab projecting membrane body which during setting is filled with grout or concrete and stably supports the concrete slab after curing.

[0002] In order to shorten the time of the decommissioning of the railways NL 1030958 (Voestalpine Railpro bv) proposed to produce a level-crossing as a one-piece prefabricated concrete slab and prior to installing to fit it with the embedded rails. In practice such product with a monolithic concrete slab proved technically and commercially unfeasible.

[0003] The object of the invention is a technically and commercially viable alternative to shorten the time of decommissioning of the track.

[0004] Therefore a method is proposed for making a railway from prefabricated concrete slab, with one or more of the following steps: in a factory two or more concrete slabs with equal or different length and with equal width and thickness are each separately made in a mold by placing a reinforcement and casting concrete so that each time a concrete slab with one or more of the following features is obtained: a in the concrete of the concrete slab embedded reinforcement of essentially parallel to the rails extending pretensioned reinforcement elements, such as steel bars or wires, possibly in bundles; at the top of the concrete slab two parallel grooves for containing the two rails; near each corner an engagement point for a hoist; two, three, four or more lengthwise and near the bottom of the concrete slab, preferably mutually at equal level and with mutual spacing, extending and in its concrete embedded and at both longitudinal sides debouching hollow channels; at one or both longitudinal sides at a place remote from top surface and bottom surface, preferably at a distance above the hollow channels, a surface profiling, preferably of such placement and / or size, that in-use two with the ends together placed slabs the surface profiling merges, eg the surface profile formed by one or more recesses and / or protrusions at a distance above and / or next to each other, such as two or more spaced projections made in the direction of the length of the rails to protrude over a distance of at least 2 or 5 or 10 cm and at the other side with said protrusions corresponding recesses shaped corresponding to the projections, and with a depth such that when two slabs are placed in one line and the projections of the one concrete slab project to maximum depth in the recess of the other concrete slab a joint between the concrete slabs with a width preferably between about 10 or 20 millime-

ters and 30 millimeters or 50 is left, which protrusions are preferably of concrete and are integrated in the slab; wherein further during the process one or more of the following operations are performed: in the mold at the ends of the concrete slab steel sections are placed widthwise approximately mid-thickness of the concrete slab with their ends protruding from the side to provide engagement points; then in succession at least two different grades of concrete are cast in layers over one another in the mold to obtain a wear-resistant coating; after curing, the slabs are removed from the molds and turned over and in placed line with each other, with the possible projections at the end side of the one concrete slab in the recess at the end side of the other but not to the maximum insertion depth, so a joint is left between the concrete slabs preferably at least 5 millimeters and 15 millimeters at the most wider (oversize) than the width of the joint in the finished product, so that the combination of these concrete slabs has a length equal to the length of the finished product, apart from the oversizing of the joint, while ensuring that the grooves for the rails on the one hand and the hollow channels on the other hand are mutually aligned and through the channels / tubes preferably flexible tension elements are laced which extend beyond the longitudinal ends of the assembly of slabs keeping them essentially stress free; shrink free mortar is cast from above into the joints between the concrete slabs so that the joints, including the possible surface profiling, is completely filled with mortar; while the mortar is still sufficient liquid, the tension elements are activated to keep the slabs permanently pressed together while mortar is pressed from the joint such that the projections at the ends are pushed deeper into the recesses so that the joint width decreases with mainly the oversize while the tension elements are brought to their final stress; one allows the mortar to cure; at the top of the plate the hardened mortar in the joint is covered with to the concrete and the mortar adhering, permanently flexible, initially form free, curing material, such as cork rubber, for permanent waterproofing of the joints; in each groove one places a unitary rail such that at both ends it projects far enough, eg. at least about 1 or 2 m, eg. about 4 m to facilitate connection with the railway to further facilitate the rails and be embedded, the assembly which rails are set and embedded; the prefabricated assembly of in one line positioned slabs containing the at final pre-load brought tension elements and in both grooves placed, set and embedded rails is hoisted onto a truck and transported to its destination and hoisted in the track.

[0005] Further, preferably one or more of the following apply: the hollow channel debouches at the one side at a level above the bottom of the plate at least 1, 2 or 3 cm higher than the level at which the hollow channels at the opposite side debouche, preferably the side with the higher level of the hollow channels is intended to be turned away from the other concrete slab in the assembly; the hollow channels follow a path through the concrete slab that is horizontal, is continuously rising or consists

of alternating horizontal and continuously rising parts; the hollow channels are across the entire length filled with shrinkfree cast mortar so the tension elements in the hollow channels throughout their length are embedded in mortar; the surface profiling at the end side consists only in the flat surface made recesses; the surface profiling includes one or more grooves running parallel to each other; the in the grooves located rails placed project hardly above the top of the plate wherein the top of the plate may be formed by a coating that is subsequently affixed to the top of the plate to provide the riding surface for cars and the like.

[0006] Preferably one or more of the following apply: provision for making adjustable feet below the concrete slabs, as an example one at every corner of a concrete slab; sufficient attention during manufacturing in the mold to ensure the required minimum galvanic resistance between the rails; in the track, the product is placed on a temporary foundation for, based on that foundation, through the pipes integral in the concrete slabs fill the support feet with grout; the rails are connected to the rails on either side of the level-crossing ; using a concrete slab or mold of a first length, eg. 6 meter and a concrete slab or mold of a second length, eg. 9 meter; exclusive use of one or more concrete slabs respectively mold of a first length and one or more concrete slabs respectively mold of a second length; use of two or three slabs at the most for making a prefabricated assembly.

[0007] Thus it has been possible for a level-crossing to prefabricate it in modular manner. Key to this showed that the tension cables preferably obtain their final tension before the filling of the joint cures or until the filling is in the early stage of curing and is not set yet. Also shown essential is that preferably the joint is first completely filled with sealing compound and then, before the sealing compound cures or sets, the joint is squeezed permanently, for example at least 5 mm and possibly up to 15 mm so that part of the stuffing is pressed out of the joint. It was learned that it may suffice to only have tension cables at the bottom of product. To undergrout is not necessary, allowing a significant time savings during installation.

[0008] By applying through the ducts running tension cables the level-crossing can be lifted in its entirety at a limited number of engagement points and there is no risk that after installation the level-crossing will have a concave or convex shape

[0009] A non-limiting example is as follows: Two concrete slabs with a length of 6 resp. 9 meter are made in the factory in a shed by placing in a 6 or. 9 meter long mold reinforcement and casting concrete. During curing vibrators are used to compact the concrete. The mostly flat bottom of the mold is equipped with profiles that provide the grooves for the rails in the concrete surface. In the mold at least two grades of concrete are cast in layers; first concrete is cast, which provides a highly wear resistant surface. Also before or during the making of the concrete slab devices are placed in the mold for the integra-

tion of the supporting legs and the connected grout pipes in the concrete slab. Also in the mold steel profiles, eg. rail pieces, are placed with a length greater than the width of the concrete slab. These profiles project approximately half the thickness of the concrete slab with their ends aside from the concrete slab and provide lifting points. And hollow tubes in the longitudinal direction of the mold are placed nearby, for example 25 cm, below the fill level of the mold.

[0010] One ensures that at the one longitudinal side of the concrete slabs two integral, identical protrusions, are made, which in side view of the concrete slab have a truncated cone-shape, with the truncated top facing away from the concrete slab while in that same view they are behind each other. In top view of the concrete slab each projection extends 1/3 of the width of the slab, while keeping a distance to the side edge of the concrete slab and keeping a larger distance to the other projection. On the other side, each concrete slab has a recess which closely fits the projection, while maintaining a joint between the sides facing each other. To maximum depth in the recess of the one slab projecting protrusion of the other slab, the concrete slabs are supported only through the projection respectively recess and the joint width is 20 mm.

[0011] After sufficient curing, the concrete slab is removed from the mold and reversed so that the in the mold to the bottom facing side with the two grooves is turned upward.

[0012] The two slabs are placed against each other so that the grooves and the hollow tubes are in line. In the hollow tubes tensioning cables are inserted whose ends extend outside the concrete slabs. On the ends one screws threaded turnbuckles, without tensioning the ropes. Along the bottom and at both sides of the seam between the concrete slabs a formwork is made after which from the top the joint is filled with mortar as liquid as water. Immediately afterwards one turns the clamping screws, which directly or indirectly press against the sides of the concrete slabs while tensioning the tension cables. Thus the concrete slabs are pressed to each other so that the joint width decreases, mortar is squeezed from the joint and eventually the concrete slabs bear mutually through the in the recesses projecting projections. Once the desired tension is built up in the tension cables the clamping nuts are secured after which the mortar in the joint is allowed to cure. After the mortar has hardened, the joint at the top of the product is to any depth then scratched open and the vacant space is filled with an adhesive, curing, flexible remaining kit or pasta so that the joint is permanently watertight from above.

[0013] The rails are then placed in the grooves and then the remaining space in the groove is filled with an initially formfree embedding and bonding material. The rails are eight meters longer than the two slabs together and project at both sides for approximately the same distance beyond the end of the two concrete slabs. After sufficient curing of said embedding material the product

is placed on a truck and transported to its destination.

[0014] At the place of destination, the product is at its four corners and elsewhere along its length by the side-ways projecting rails attached to the lifting hook of a crane and lifted to its final destination. Bearing on a temporary foundation, the product is set, after which the supporting legs are filled with grout.

[0015] After sufficient curing of the grout, the temporary supports are removed and the set concrete product bears on its feet.

[0016] In one alternative, the level-crossing is directly from the transport vehicle placed on a levelled sand bed as its final destination, and use of a temporary foundation, setting the product and filling of the supporting feet is superfluous

[0017] The attached drawing shows in Fig 1 a perspective view of a portion of a concrete slab according to an implementation of the invention and fig. 2 shows a side view in section along the line II-II in fig. 1 of a portion of two in line positioned slabs of fig. 1 to create a level-crossing according to the invention.

[0018] Illustrated are the slabs 1, the grooves 2 for the rails 3, the lifting points 4, the surface profiling 5 in the ends, the hollow tubes 6 and the joint 7.

[0019] In fig. 1 the rails 3 are missing and in both figures the wires in the tubes 6 are missing. The tubes 6 debouch below the profiling 5 are aside each other and run from the joint 7 inclined upward to the opposite side (this applies to both the plate 1 to the one or the other side of the joint 7). The profile 5 consists of three horizontal grooves running over each other. The rails 3 project outside the concrete slabs (Fig. 2).

[0020] Other versions belong to the invention. E.g. where the projections and possibly also the matching notches on the end side of each plate are missing, or each side of each plate contains both slots and matching protrusions, or each side of each slab only contains notches. The slabs could also on their sides at two or more levels be fitted with protrusions and/or matching recesses. It should be clear that the intention is that protrusions on the end side of one plate fit into notches on the end side of an adjacent plate.

[0021] The product can, apart from the rails, have a length created by the assembly of one, two or more pieces of 6 or 9 meter, so that one creates a length of 6 meter plus or a multiple of 3 meter, for example 18 or 27 meter.

Claims

1. Method for making a prefabricated railway level-crossing with a minimum length of ten meters from two or more prefabricated concrete slabs, each with a minimum length of five meters, with in a factory the two or more slabs of equal width and thickness and together with a length essentially equal to the level-crossing are manufactured by in a mold for each placing reinforcement and at least two parallel hollow

tubes (6) and pour concrete so that concrete slabs in each mold are manufactured upside down which by curing in the mold obtain the following properties: near the bottom in use run the hollow tubes (6) next to each other and at mutually equal level lengthwise of the level-crossing and at the top two parallel grooves (2) run to therein house the rails (3), while after demolding the two or more cured concrete slabs (1) are in the plant arranged in one line so that the grooves (2) and duct (6) are mutually aligned in maintaining a joint (7) between the two connecting concrete slabs and in each tube (6) one or more tension elements are arranged so that each tension element coverings essentially the entire length of the level-crossing, and the one or more joints (7) are filled with an initially formfree filler and the tension elements are brought to the desired final tension and the rails are placed, set and fixated in the grooves (2), such that after the curing of the filler the slabs are permanently fixed to each other and the thus prefabricated level-crossing with to the final tension brought pretension elements and in the two grooves, placed, set and embedded rails is from the factory transported to its final destination and the rails (3) thereof are connected to the rails of the railway on either side of the level-crossing.

2. Method according to claim 1, whereby the tension elements are brought to the desired final tension while the filler is not cured yet, so that while tensioning the tension elements the slabs are moved toward each other in reducing the width of the joint, preferably over at least about 5 millimeters, and a part of the filler is pressed from the joint (7).

3. Method according to claim 1 or 2, ensuring that the concrete slabs during forming in the mold obtain at one or both ends at a place remote from the top surface and bottom surface, preferably at a distance above the hollow channels, a surface profiling (5), preferably consisting exclusively of recesses made in the flat surface, such as one or more grooves running parallel to each other, which profiling (5) is of such placement and size that of two slabs placed in the in-use condition with the ends together have the surface profiling merging, and which surface profiling is part of the joint (7) and when with filler filling the joint is also completely filled with filler.

4. Method according to one of the claims 1-3, ensuring for the concrete slabs that when forming in the mold the ducts (6) at the one end debouch at a level above the bottom of the plate at least 1, 2 or 3 cm higher than the level at which the tubes debouch at the opposite end, preferably while following a path that is continuously rising or alternately horizontally and constantly rising, and possibly wherein the end with

the higher level of the tubes is placed facing away from the other slab in the assembly which shares the joint (7)

bedded in hardened filler.

5. Method according to one of the claims 1-4, which during the from the slabs composing of the level-crossing the ducts (6) over the full length are filled with initially formfree material so that the tension elements in the tubes over their entire length are embedded in hardened filler. 5
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6. Prefabricated level-crossing with a minimum length of ten meters, which is composed of two or more prefabricated concrete slabs, each with a minimum length of five meters and of equal width and thickness, and together with a length essentially equal to the level-crossing and at least two parallel in the length of the level-crossing concurrent hollow tubes (6) near the in use bottom at mutual equal level and with at the top two parallel grooves (2) containing embedded rails (3) protruding at both ends beyond the assembly of concrete slabs, and in each duct (6) one or more tension elements at final pretension so that each tension element extends substantially the complete length of the level-crossing through all slabs, and with a joint between the slabs (7) which is filled with an initially formfree filler with which the slabs are permanently fixed together, so that the thus prefabricated level-crossing with the at the final pretension brought pretension elements and in both grooves located, set and embedded rails can be transported from the factory to its final destination and its rails (3) can be connected to the rails of the track at both sides of the level-crossing . 15
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7. Railroad level-crossing according to claim 6, where the joint (7) on both sides is bounded by a mutually overlapping surface profiling (5) in the sides of the concrete slabs at a distance from the top surface and bottom surface and above the hollow tubes (6) , preferably consisting exclusively of recesses made in the flat surface, such as one or more grooves running parallel to each other, completely filled with filler. 40
8. Railroad level-crossing according to claim 6 or 7, the ducts (6) on the one side debouch at a level above the bottom of the plate at least 1, 2 or 3 cm higher than the level at which the tubes on the other side debouch, while following a path that is continuously raising or alternately horizontally and continuously raising, and where the side with the higher level of tubes placed facing away from the slab of the assembly sharing the joint (7) 45
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9. Railroad level-crossing according to claim 6, 7 or 8, where the ducts (6) over the full length are filled with initially formfree filler material so that the tension elements in the tubes are over their entire length em- 55

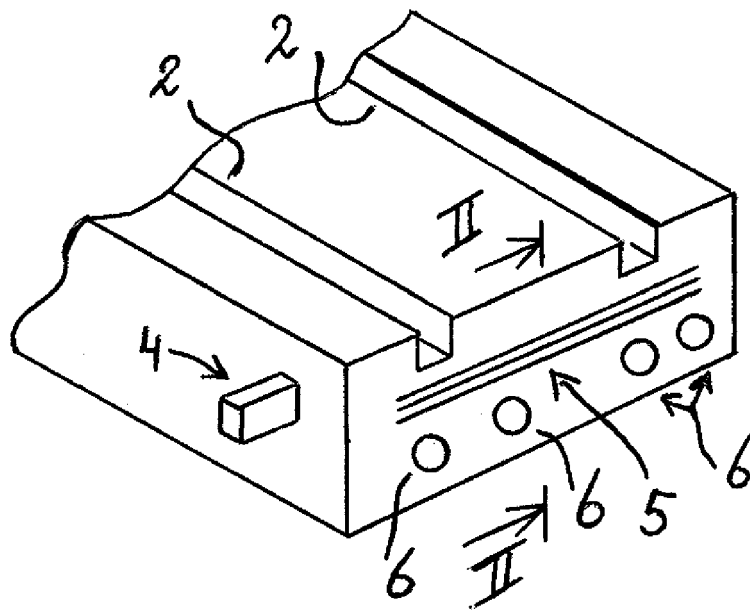


Fig. 1

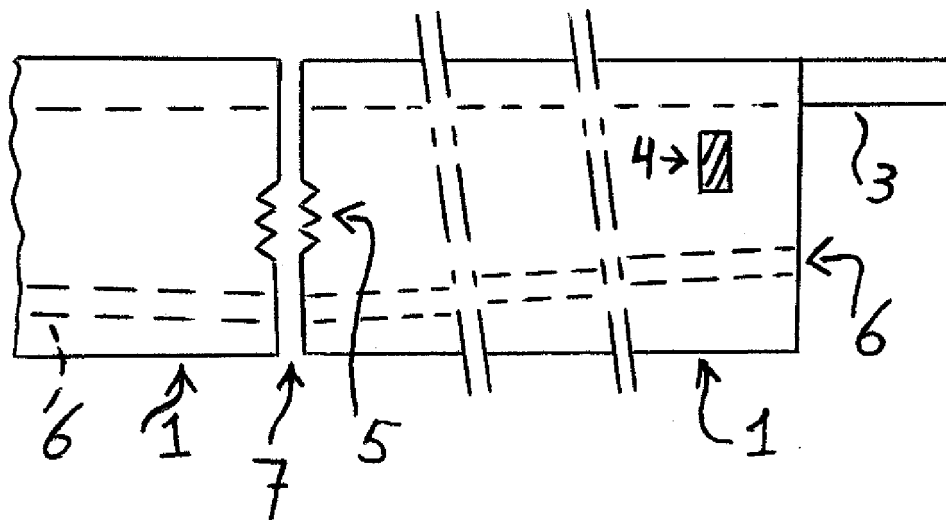


Fig. 2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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