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(54) LONGITUDINAL MODULAR SYSTEM WITH BOARDS FOR TWIN-TRACK RAILWAY BRIDGES AND CONSTRUCTION METHOD

(57) A longitudinal modular system with boards (3) for underpass bridges for installation of two tracks for railway circulation in which the board (3) is placed between two consecutive piers (4) and comprises a pair of longitudinal beams (1), which themselves comprise a lower wing (1c), for supporting on the piers (4), a core (1b) and an upper wing (1a); and a plurality of transversal slabs (2) that are attached to the lower wings (1c) of the longitudinal beams (1), thus forming a U-shaped configuration, where the length of the longitudinal beams (1) is essentially similar to the span between two piers (4), and the configuration of the board (3) has a transversal, U-shaped section such that the railway circulates inside said U shape. The invention also describes the method for constructing same.

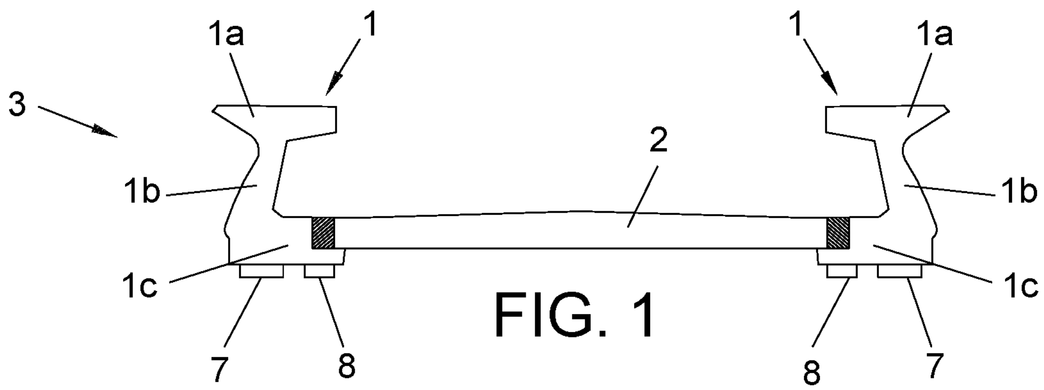

FIG. 1

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Description

OBJECT OF THE INVENTION

[0001] The present invention refers to a novel system of manufacture and construction of decks of bridges or viaducts with two tracks for light railways or metros, to be used in urban areas, with the particularity of having an open cross-section, in the shape of a U, being the two tracks located inside the deck.

[0002] It has special application in the field of industry related to the construction of decks for railway tracks.

TECHNICAL PROBLEM TO BE SOLVED AND BACKGROUND OF THE INVENTION

[0003] In the current state of the art the construction of elevated metros and light railways is being carried out through the execution of viaducts. This is replacing the traditional underground construction, mainly due to construction and maintenance costs. Within this type of construction, it is a common solution to make bridge or viaduct decks with a U-shaped cross section in which the railway circulates inside the structure. In the case of double-track railways, there are two possible alternatives. The first consists in the realization of two independent decks, one for each track. The second alternative consists of the realization of a single deck that houses the two tracks.

[0004] In this kind of construction, the usual structural typologies consist of concrete decks, concreted structures, whose execution can be carried out in situ, that is, on site, or by prefabrication of segments, prefabricated structures, which are subsequently transported to the site for assembly.

[0005] The structures concreted in situ can be executed on formwork supported on the ground by means of scaffolding or using steel girders that are supported on the piers to span the complete span between piers, called MSS (Movable Scaffolding System).

[0006] The precast structures are usually formed by segments, elements that are built in a precast yard and then transported to the construction site and placed by different processes that, in general, require the use of auxiliary means and impose an execution span by span, in order, following the railway line defined by the piers.

[0007] The current technology of complete precast decks is focused on construction for its use in one-way track decks. The construction of the deck consists of a U-beam of the same length as the complete span between piers. This structure is transported to the site in a special transport that can circulate on the roads or streets of the cities, as its size does not exceed the permitted limits. Subsequently, by using cranes, this kind of U-beams are lifted and placed over the spans delimited by the piers that define the different sections of track.

[0008] However, the use of this technique is not possible for the decks that house two tracks. The reason is that the width of this kind of structures, which is not less than 10 meters, is greater than the maximum allowed to be transported by road or through the streets of a city. In this way, when the possibility of being transported is discarded, the option of executing the full span in situ, on site, could be considered. However, this solution would not be profitable either because it is not possible to start with the deck until the substructure was executed and a solution in situ is much slower than the assembly of a precast solution.

[0009] For this reason, the manufacture of double-track decks is considered unviable through this type of solution. On the other hand, for this kind of structures, the method used consists of a solution based on the transversal segmentation of the deck in segments of a width compatible with their transport by road to the construction site. To assemble them in their definitive position, auxiliary means specially constructed for this purpose are used. These auxiliary means consist of steel girders that rest on the piers, equipped with a lifting system that allows to lift all the segments of a span to join them later by longitudinal prestressing.

[0010] However, this construction method, despite being frequently used, presents a series of inconveniences such as those described below.

[0011] First, the manufacture of the segments is very complex and involves not only the need for large manufacturing facilities, but also the employment of a large number of personnel. In addition, the segments are manufactured in conjugate form so each segment has a unique position. If a segment breaks during any phase of the process or any unexpected altercation occurs, the assembly is paralyzed until another identical segment to the one that has been broken is built.

[0012] On the other hand, the necessary auxiliary means on site for the lifting and subsequent placement and joining together of the different segments also implies a high cost in terms of assembly and disassembly.

[0013] In addition, the use of this method of construction involves a chain assembly, so that the reception on site of segments must be well coordinated with the assembly and it is essential that the complete infrastructure (foundations and piers) is completed in advance for that stoppages do not occur with the auxiliary means. If for some reason, such as a diversion of a utility that is complicated, a break of a segment, etc., the assembly can be paralyzed and to continue in another part of the viaduct it is necessary to disassemble and reassemble the auxiliary means. This triggers assembly costs and deadlines.

[0014] The present invention comes to solve the aforementioned problems, which are not resolved in the present state of the art, by the construction of precast beams that are subsequently transported on site for assembly, completing a span with two longitudinal beams and a series of transverse slabs that are located between the beams. This implies a reduction in the following aspects:

- construction costs, without the need for large facilities or a large number of personnel,
- costs of auxiliary means for the assembly, only needing cranes for the lifting of the beams, without the need of having auxiliary means for assembly such as segmental gantry or beam launcher,
- time of implementation and execution of the work, because the number of elements to be prefabricated and assembled is much lower than in the system with segments. In addition, the beam is a much easier element to precast than the segment.
- schedule associated with the problems that occur in a span built by segments, as the execution and assembly of a span is independent of its location. Indeed, it is not necessary that the launching girder has reached the span in question. In case a pier is not built in the stipulated time, the construction is not stopped, since the assembly of the spans does not need to be sequential and it is possible to work simultaneously in different spans that can be located in different areas of the viaduct.

DESCRIPTION OF THE INVENTION

BRIEF DESCRIPTION OF THE FIGURES

[0015] To complete the description of the invention and in order to help a better understanding of its characteristics, according to a preferred example of realization of the same, there is attached a set of drawings in which, for illustrative purposes and without limitation, it has been represented the following figures:

- Figure 1 represents an elevation view of the structure of the deck to be built, formed by two longitudinal beams and a series of transverse slabs supported between the two beams.
- Figure 2 represents a plan view of the deck defined in figure 1.
- Figure 3 represents a side view of the deck defined in Figure 1 installed on two piers.
- Figure 4a represents an elevation view of the beginning of assembly of the first longitudinal beam between two piers. Due to the view of the figure, only one beam is visible, but the beams are supported at their ends in the piers, as shown in figure 3.
- Figure 4b represents an elevation view of the beginning of the assembly of the second longitudinal beam as a next step of Figure 4a for the construction of the deck.
- Figure 4c represents an elevation view of the final assembly of the second longitudinal beam as a next step of Figure 4b for the construction of the deck.
- Figure 4d represents an elevation view of the assembly of the transverse slabs between the two longitudinal beams as a next step of Figure 4c for the construction of the deck.
- Figures 5a to 5d represent views in elevation of the installation sequence of the structure of the invention from the two longitudinal beams.
- Figures 6a and 6b respectively represent a side and rear view of a truck transporting a longitudinal beam of those used in the invention.
- Figures 7a and 7b respectively represent a side and rear view of a truck transporting a plurality of transverse slabs of those used in the invention.

[0016] Below is a list of the references used in the figures:

1. Longitudinal beam.
1a. Bottom flange.
1b. Web.
1c. Top flange.
2. Transversal slab.
3. Deck.
4. Pier.
5. Crane.
6. Truck.
7. Permanent bearing.
8. Temporary bearing.

DESCRIPTION OF A PREFERRED REALIZATION OF THE INVENTION

[0017] Considering the numbering adopted in the figures, the present invention consists in the development of a novel system for the manufacture and construction of bridge deck structures (3) for bridges or viaducts for double-track installations for the circulation of urban railways, either metro or light rail, with the particularity that the structure is open with a U-shaped cross section so that the double track is housed inside.

[0018] The structures of the decks (3) are intended to be located on a series of piers (4) that define spans, or free length between piers (4), which must be spanned by the decks (3), as shown in figure 3

[0019] Figures 1 and 2 represent views of the structure of the deck (3), which is composed of two longitudinal beams (1) and a series of transverse slabs (2) resting on the longitudinal beams (1) at their ends. As shown in figure 1, the longitudinal beams (1) are composed of a bottom flange (1a), by means of which the beams (1) rest on the piers (4), a web (1b), which it brings to the beam (1) the height on the base on which it supports, and an upper flange (1c) for the possible support of other structures. The bottom flange (1a) can protrude on both sides of the web (1b) of the beam (1), although it usually only protrudes on one side. The upper flange (1c), in the same way, can protrude on both sides of the web (1b), on one of the sides only or even be formed by a widening of the core (1b). In any case, it typically has a characteristic "C", "T", " I " or "L" shape, depending on the configuration of the flanges (1a, 1c) and the web (1b). The two longitudinal beams (1) are positioned facing each other and between them the transverse slabs (2) are located, resting on each of the bottom flanges of the longitudinal beams (1), configuring the deck (3) with a shape of "U", as mentioned and shown in figure 2. This form of "U" must be understood in a broad sense since, although it has been commented that the longitudinal beams may have a "C" shape and it could be considered that the deck (3) also has an approximate "C" shape (with the variations mentioned above), the reality is that the dimensions of the upper flange (1c) of the longitudinal beams (1) is not significant compared to the rest of the dimensions of the board (3).

[0020] The contact of the longitudinal beams (1) on the piers (4) is made by bearings (7,8), typically made of rubber, neoprene or similar material, to absorb movements and prevent both elements from contacting directly. In this way, between the piers (4) and the longitudinal beams (1) there is a permanent bearing (7) and also a temporary bearing (8), the latter being intended for stability during the construction of the decks (3), provisional support can be replaced by another provisional system that performs the same function.

[0021] The longitudinal beams (1) are prefabricated and have a similar length to the span between two consecutive piers (4) where they are supported, also joining longitudinally to the previous longitudinal beam (1). The longitudinal beams (1) are located on each side of the cross section of the piers (4). The transverse slabs (2) are assembled on the bottom flanges (1a) of the longitudinal beams (1), so that the interior space between the longitudinal beams (1) and the transverse slabs (2), configured in a "U" shape", is destined to the location of the two tracks through which the railways will circulate.

[0022] The transverse slabs (2) are fixed to the ends of the bottom flanges (1a) of the longitudinal beams (1), resting on them to form a monolithic and stable element in its final state by means of specific joints. On these transversal slabs (2) is located the railway platform which, due to this form of construction, is called ballastless or ballasted tracks.

[0023] In this way, as shown in Figure 3, each deck (3) is located supporting each of the ends in a pier (4) and, as the decks (3) are having a length similar to the span between two consecutive piers (4), rest on them occupying half of the longitudinal area of the head of the pier (4), leaving the other longitudinal half of the pier (4) for the location of the next deck (3).

[0024] The main features of the present invention are those described below.

[0025] First, the deck (3) is not manufactured by transverse segments, as has been done in the state of the art, but by longitudinal beams (1) of a length similar to the span defined by the distance between two piers (4) of the viaduct destined to accommodate the double-track. These longitudinal beams (1) constitute the lateral sections of the deck (3).

[0026] Secondly, transverse slabs (2) are used, supported between the longitudinal beams (1) by their bottom flanges (1a) and connected so that the final set in the form of U being pursued is monolithic. A representation of this configuration is shown in figures 1 and 2. In figure 2 it can be seen how, between the two longitudinal beams (1) is arranged a plurality of transverse slabs (2) that cover the intermediate area between the two longitudinal beams (1). This area, as mentioned, is intended to house the two railway tracks.

[0027] Third, the deck (3) is configured in a "U" shape, focused on housing a double railway track inside. This differs from another very usual current technique consisting of the construction of two longitudinal beams, located between piers, above them a slab is located on which a double railway track runs. In this case, each of the beams may have a "U" shaped cross section, being separated or joined together in the form of a "W", which presents a great disadvantage with respect to the present invention, especially as regards to manufacturing and assembly costs, since a longitudinal "U" beam and a slab, although shared, are needed for each of the two railway tracks.

[0028] The assembly of the structure of the deck (3) of the modular system of the invention is represented in the sequence defined by figures 4a to 4d. To understand this assembly, it is necessary to take into account Figure 3, to see that the longitudinal beams (1) rest on two piers (4) at the ends, since in the side views shown in Figures 4a to 4d, only is shown one of the piers (4).

[0029] The longitudinal beams (1) are transported in trucks (6), as will be commented below, which are parked between the two piers (4) between which the longitudinal beam (1) will be located to facilitate its later collection and erection up to the pier (4) by a crane (5).

[0030] As shown in figure 4a, by means of a crane (5), the longitudinal beam (1) located on the truck (6) is hooked and raised to position each of the ends on one of the sides of each of the piers (4) between which it supports. Subsequently, once the first longitudinal beam (1) is located, the operation is repeated with a second longitudinal beam (1), picking up the beam (1), as shown in Figure 4b, and positioning the ends on the other side of the piers (4), as shown in Figure 4c. As shown in Figures 4a and 4b, the piers (4) already have on top the bearings (7, 8) for the location of the longitudinal beams (1).

[0031] It must be taken into account that, for the support of the longitudinal beams (1) on the piers (4), bearings (7, 8) are placed on the piers (4) that define the position of the longitudinal beams (1) and avoid direct contact between the two elements.

[0032] Finally, transverse slabs (2) are collected with the crane (5) to position them between the longitudinal beams (1), as shown in Figure 4d to finalize with a configuration according to the one provided in Figure 3.

[0033] The construction of the deck (3) is defined in Figures 5a to 5c, although neither the piers (4) nor the bearings (7, 8) have been represented in these figures.

[0034] Figure 5a shows how initially the two longitudinal beams (1) should be positioned, facing symmetrically and resting inferiorly on the bottom flange (1a), which serves as the base. In these figures, it can be checked that the section of the longitudinal beam (1) may not be horizontal, as shown in Figure 1. This is because it may be convenient, for aesthetic or materials resistance reasons, that the bottom flange (1a) vary the inclination, although in the area at the ends, where it rests on the piers (4), it is always horizontal, parallel to the upper flange (1c).

[0035] Subsequently, both the absolute position of the longitudinal beams (1) on the piers (4) and the relative position between the longitudinal beams (1), it is convenient that are controlled by means of a bracing of those known in the state of the art, as it can be by incorporating auxiliary beams that connect the upper flanges (1c) of the longitudinal beams (1) so that, both the separation distance between the longitudinal beams (1) and the parallelism between them, is defined and also the stability against overturning of the longitudinal beams (1) is guaranteed. Other means of bracing can be by placing mechanical stops that indicate without question the position of each of the longitudinal beams (1) or by fixing the beams (1) by wiring.

[0036] Subsequently, as shown in Figure 5b, the transverse slabs (2) are placed, placing them supported on the free ends of the bottom flanges (1a) of the longitudinal beams (1).

[0037] Subsequently, to ensure that all the elements form a monolithic structure, the longitudinal beams (1) and the transverse slabs (2) are fixed firmly, as shown in Figure 5c, either by filling the joints with concrete, with mortar or by any other fixing means known in the state of the art.

[0038] Finally, the transverse slabs (2) are joined together, either by threading and prestressing tendons or steel bars, or by leaving a separation between the transverse slabs (2) that are filled with concrete once they are all positioned for guarantee to convert the independent slabs (2) into a monolithic slab.

[0039] Once it has been ensured that the joining method between beams (1) and transverse slabs (2) used has been completed, either by hardening the concrete or mortar of the joints, or any other method used, the provisional bracings that could have been placed in an earlier stage are removed. then the construction of the deck is being completed (3).

[0040] The advantages of the present invention with respect to the state of the art are based on three concepts:

a) the needs in terms of production of the construction elements,
b) the transport of the constructive elements, and
c) the needs for the placement of the constructive elements.

[0041] Regarding the production needs, consider that, by means of this construction process, all the structural elements, both the longitudinal beams (1) and the transverse slabs (2), require manufacturing conditions that are quite small in terms of facilities. Facilities for a production of three beams (1) per week per cast and considering a total of two casts, can consist of a shed of 180 meters in length and 25 meters in width. For the collection of components and finished elements would require an esplanade of 200x60 m^2. Since the production depends mainly on the number of casts available, the way to increase it is achieved mainly with the increase in the number of casts.

[0042] Regarding the transportation of the construction elements, consider that the longitudinal beams (1) can be transported to the site in conventional transports, such as trucks (6), appropriately adapted for the displacement of elements of great length, where two trailers are used with a single tractor, as shown in Figures 6a and 6b. On the other hand, the transverse slabs (2), which measures can be 3 meters wide by 7 meters long, are located in conventional vehicles, i.e. usual trucks (6), that can load without problems four transverse slabs (2) by simply turning them to position them along the length of the truck loading platform (6).

[0043] Finally, regarding the needs on site for the placement of the construction elements, the longitudinal beams (1) can be erected by conventional cranes (5), without great technical requirements, so that, for example, two cranes (5) LTM 1500 can be used. The transverse slabs (2) can be erected in the same way, for example by using a crane (5) LTM 1160 or, even, by gantry cranes (5) supported on the longitudinal beams (1). In this way, the raising and subsequent installation of the prefabricated elements is quite simple. In Figures 4a to 4c it can be seen how the assembly of the longitudinal beams (1) is carried out, while in Figure 4d it can be seen how the assembly of the transverse slabs (2) is carried out. The construction rate, considering a team of two cranes (5) LTM 1500 with six operators for the longitudinal beams (1) and a team of a crane (5) LTM 1160 with five operators for the transverse slabs (2), is calculated that it can be of two beams (1) per night and a span of slabs (2) per day. The construction is based on the number of teams, so it can be regulated according to needs.

[0044] The savings in execution time due to the lower complexity of the manufacturing plant, the lower cost of transport and savings in erection and assembly of elements can exceed 37% compared to the traditional way of building by erecting transverse segments. This, without counting the losses due to delays caused by lack of synchronization or errors in the delivery of material on site or stops due to delays in the construction of the piers (4) where the launching gantry that raises the segments is supported. In addition, this prefabrication methodology reduces the increasing of schedule associated with the problems that occur in a span built by segments, as it is independent the execution and assembly of a span of its location (does not need that the launching gantry has reached that span) and as many spans as desired can be executed simultaneously depending on the disposition of a greater number of automobile cranes, of great availability in the market and with easy mobilization period.

[0045] The advantages of the construction method allowed by the present invention are therefore based on the flexibility to prefabricate, on the viability of transport with conventional means, on the ease and speed in the arrangement of the cranes necessary for the assembly of construction elements, in the flexibility in the assembly of elements along the railway, because they can be assembled alternately, by not depending on the supply of certain elements and by the speed in the assembly of stations, as it is possible to build the spans before and after the station at the same time than the station itself.

[0046] This manufacturing configuration using precast longitudinal beams (1) and transverse slabs (2) located over the longitudinal beams (1) is known in the state of the art, as it has been mentioned above, although for the construction of closed structures where the railway circulates above the structure, or for the construction of beams on which a slab is subsequently placed above, on which the railway circulates, without having been able to develop effectively for the construction of open structures for the location of a double railway track where the railway circulates through its interior, a requirement that is essential in the type of constructions to which the present invention is dedicated, that is to say, the circulation of railways inside the deck (3).

[0047] Anyway, it must be taken into account that the present invention should not be limited to the way of realization described here. Other configurations may be made by those skilled in the art in view of the present disclosure. Accordingly, the scope of the invention is defined by the following claims.

Claims

1. : Longitudinal modular system by means of decks (3) of bridges for the installation of double-track for the circulation of railways, the modular system is **characterized by** that the deck (3) is located between two consecutive piers (4) and comprises:

   - A pair of longitudinal beams (1) comprising a bottom flange (1a), intended to be the support on the piers (4), a web (1b), intended to raise the structure of the deck (3) and an upper flange (1c), designed to accommodate an additional structure
   - A plurality of transverse slabs (2) intended to be fixed by their ends on the bottom flanges (1a) of the longitudinal beams (1), which support as a base on the piers (4), to achieve a configuration shape of an "U",

   where:

   - the length of the longitudinal beams (1) is substantially similar to the span between two piers (4), and
   - the configuration of the deck (3) has a "U" cross section so that the railway runs inside this "U" shape.

2. Longitudinal modular system by means of decks (3) of bridges for the installation of a double track for the circulation of railways, according to claim 1, **characterized in that** between a pier (4) and the deck (3) there is a definitive bearing (7) to avoid direct contact between the two elements.

3. Longitudinal modular system by means of decks (3) of bridges for the installation of a double track for the circulation of railways, according to claim 1, **characterized in that** a provisional bearing (8) is located between a pier (4) and the board (3) for the levelling of the longitudinal beams (1) and to avoid their overturning.

4. Construction method of the longitudinal modular system described in claim 1, **characterized in that** it comprises the following phases:

   a) Manufacturing of longitudinal beams (1) and transverse slabs (2),
   b) Transportation of a pair of longitudinal beams (1) to the piers (4) on which they will be located,
   c) Lifting and placing a first longitudinal beam (1) on the piers (4),
   d) Lifting and placing a second longitudinal beam (1) on the piers (4),
   e) Transportation of a plurality of transversal slabs (2) to the piers (4) on which they will be located,
   f) Lifting and sequential positioning of a plurality of transverse slabs to complete the length of the longitudinal beams (1),
   g) Fixation of the transverse slabs (2) to the longitudinal beams (1),

5. Construction method of the longitudinal modular system, according to claim 2, **characterized in that** after phase d) comprises the following phase:
   h) Place bracing means for controlling the position of the longitudinal beams (1) both absolute, with respect to the piers (4), and relative, with respect to themselves.

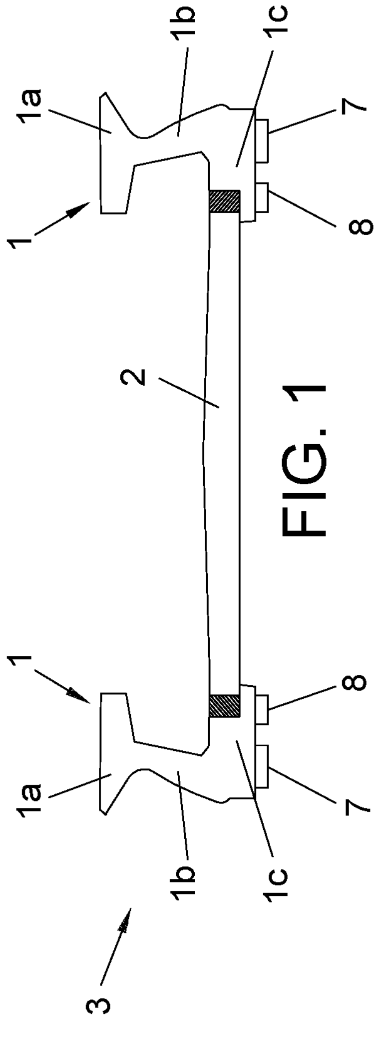

FIG. 1

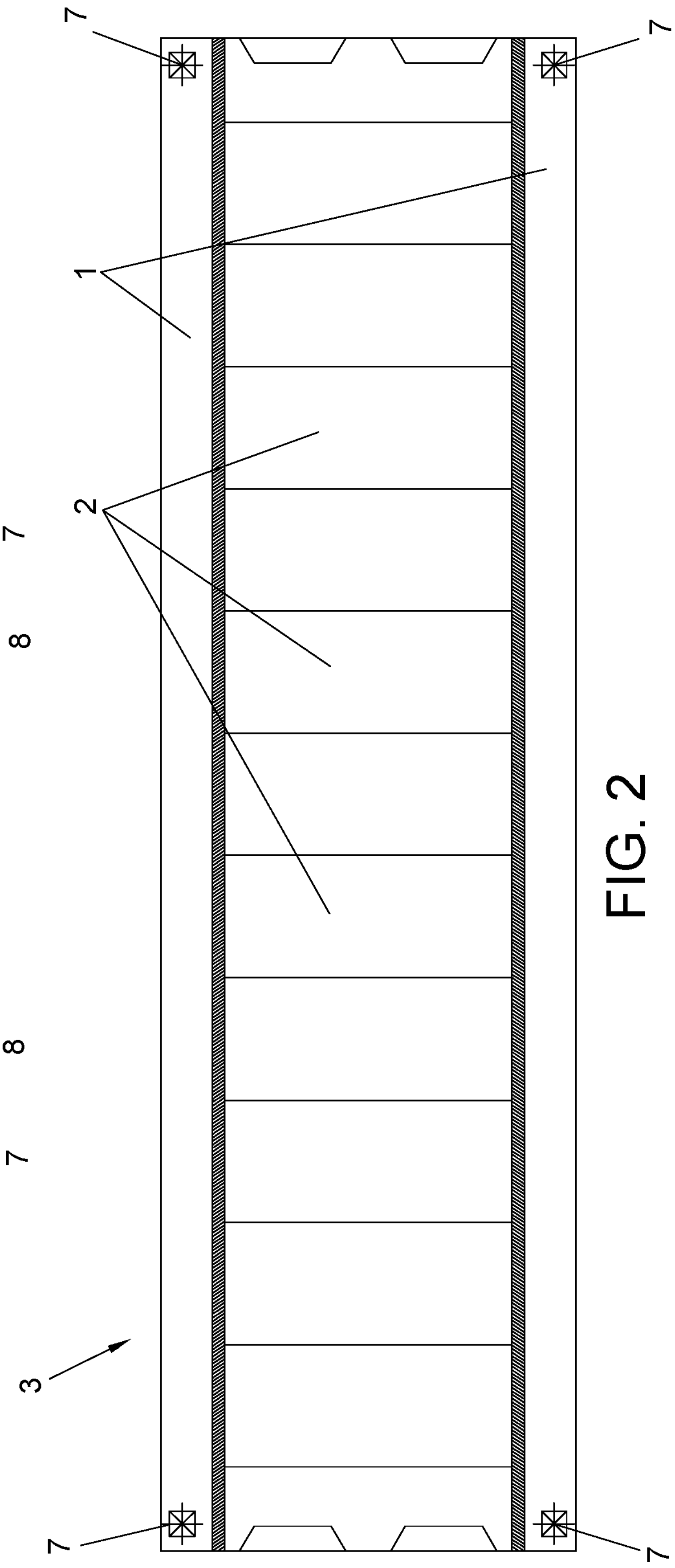

FIG. 2

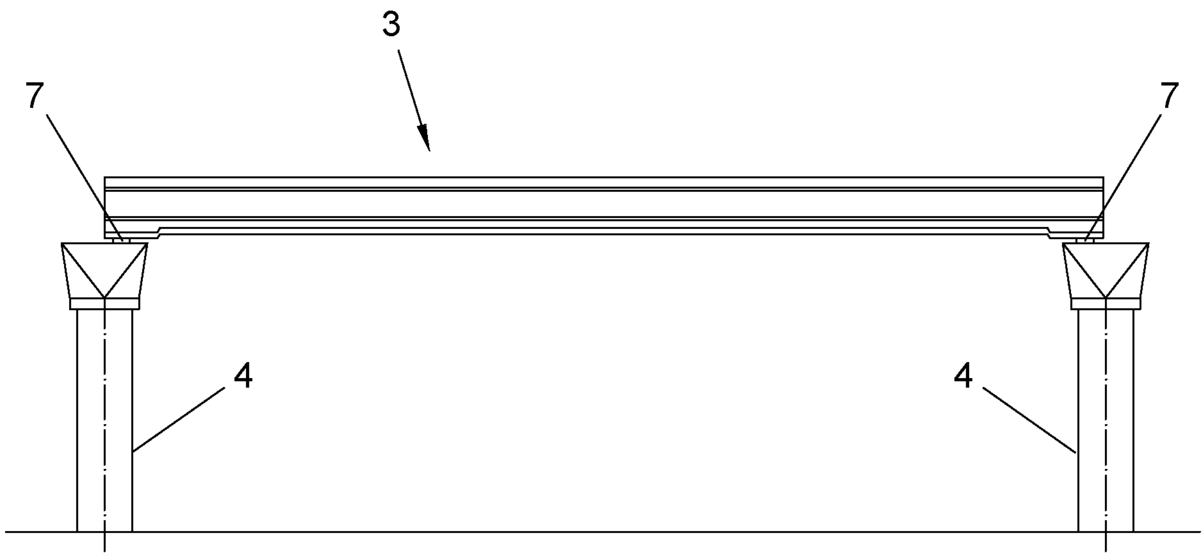

FIG. 3

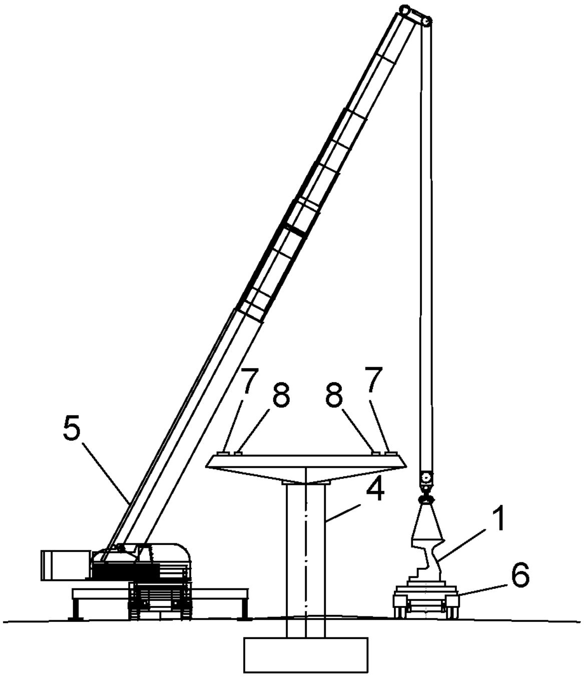

FIG. 4a

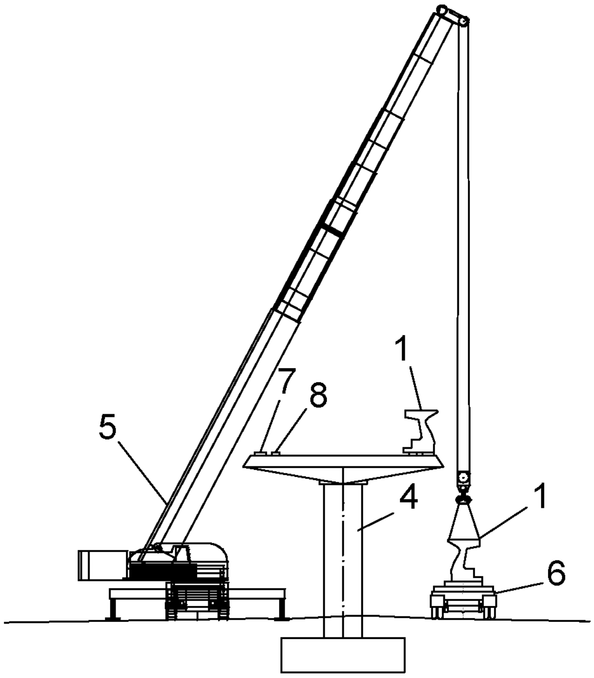

FIG. 4b

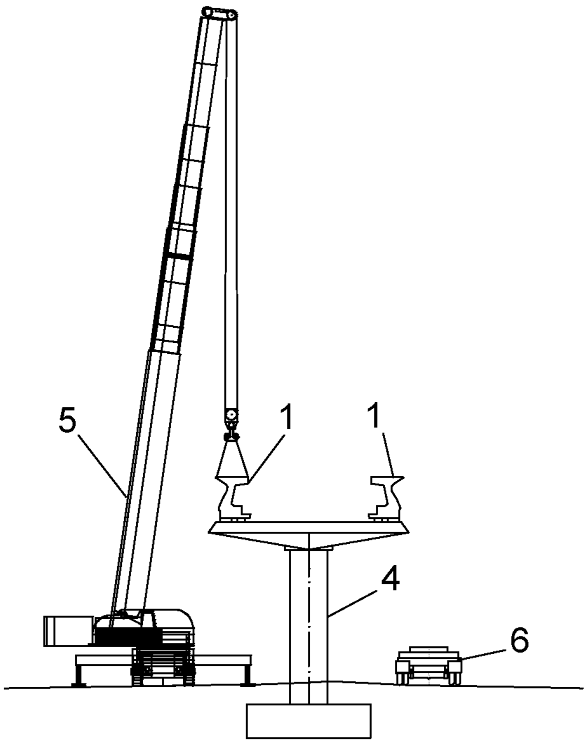

FIG. 4c

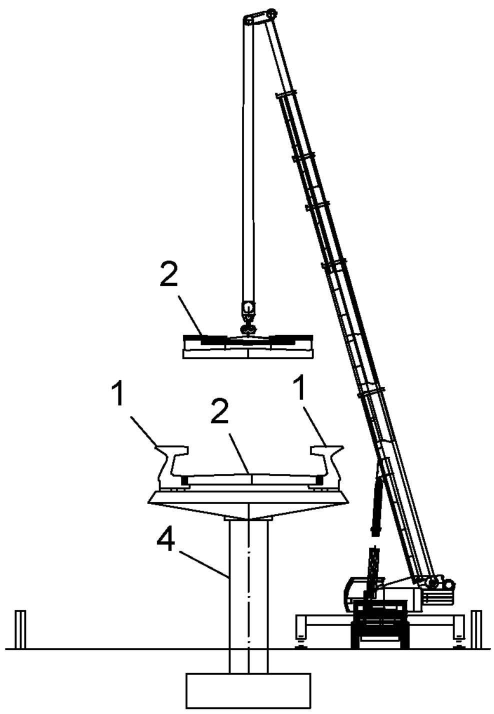

FIG. 4d

FIG. 5a

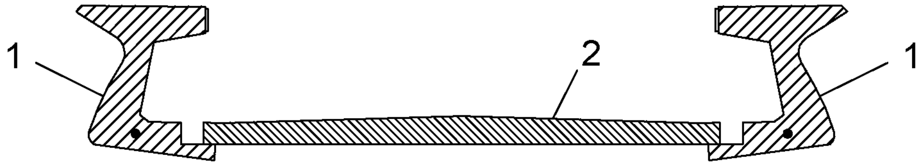

FIG. 5b

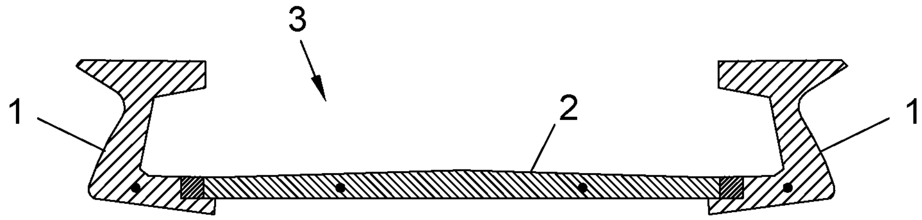

FIG. 5c

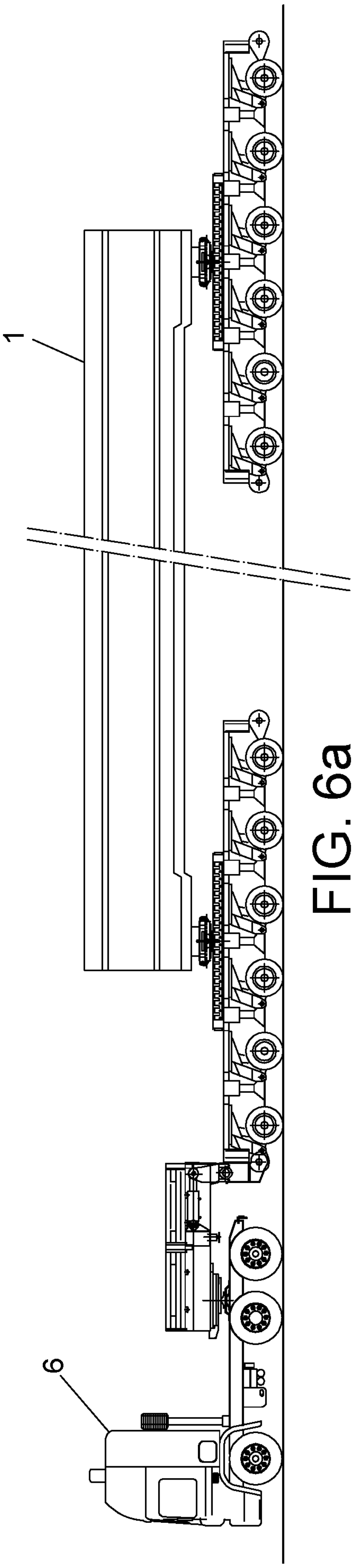

FIG. 6a

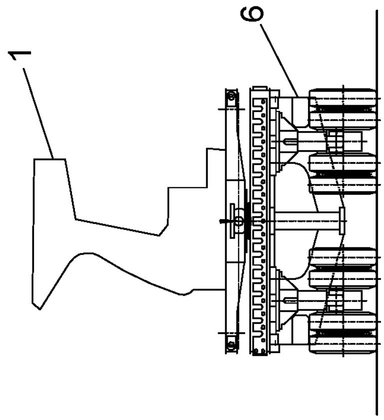

FIG. 6b

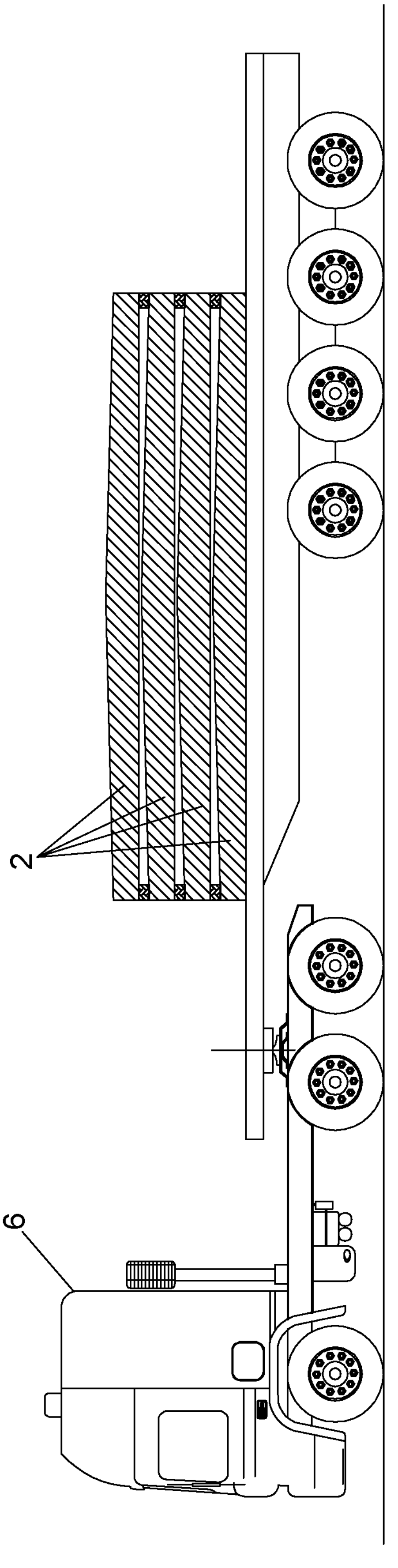

FIG. 7a

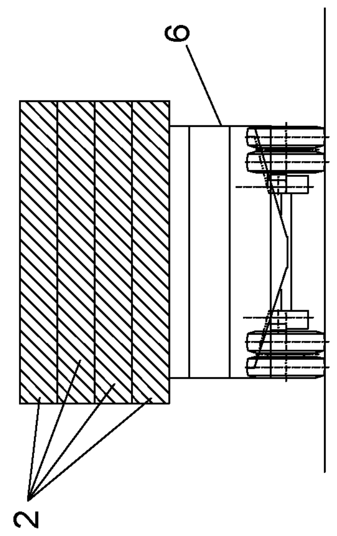

FIG. 7b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2018/070639

A. CLASSIFICATION OF SUBJECT MATTER

E01D15/133 (2006.01)
E01D19/00 (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, INVENES

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 20110031816 A (BRIDGE TECHNOLOGY CO LTD) 29/03/2011, & Abstract from DataBase EPODOC. Retrieved from EPOQUE; AN KR-20090089225-A; figure 2, 3a, 4a, 4b and 6a	1-5
X	FR 2755451 A1 (CAMPENON BERNARD SGE) 07/05/1998, & Abstract from DataBase EPODOC. Retrieved of EPOQUE; AN FR-9613613-A; figures.	1-5
A	WO 2013095087 A1 (FDN CONSTRUCTION BV) 27/06/2013, & Abstract from DataBase EPODOC. Retrieved of EPOQUE; AN NL-2012000075-W; figure 1.	1-5
A	KR 100720996B B1 (SAMPYO ENG & CONSTR LTD) 16/05/2007, & Abstract from DataBase WPI. Retrieved from EPOQUE; AN 2008-F73833; figure 1a.	1-5

☒ Further documents are listed in the continuation of Box C.　　☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance.	
"E" earlier document but published on or after the international filing date	
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"O" document referring to an oral disclosure use, exhibition, or other means.	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other documents , such combination being obvious to a person skilled in the art
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search 03/06/2019	Date of mailing of the international search report **(06/06/2019)**
Name and mailing address of the ISA/ OFICINA ESPAÑOLA DE PATENTES Y MARCAS Paseo de la Castellana, 75 - 28071 Madrid (España) Facsimile No.: 91 349 53 04	Authorized officer R. Puertas Castaños Telephone No. 91 3498509

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2018/070639

C (continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	KR 20180009902 A (PARK JUNG JA) 30/01/2018, & Abstract from DataBase EPODOC. Retrieved of EPOQUE; AN KR-20160091790-A; figure 1.	1-5

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/ES2018/070639

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