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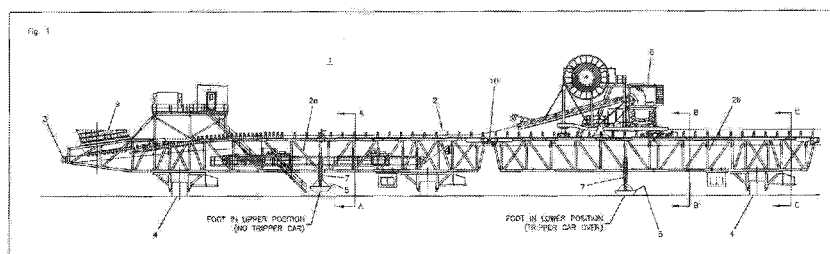
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(54) Title: MOBILE CONVEYOR APPARATUS



(57) Abstract: Disclosed is a mobile conveyor apparatus (1) comprising a bridge (2) provided with at least one transport means (3) for conveying material in the longitudinal direction of the bridge (2) and support means (4,5) extending from the bridge (2) to the ground whereon the mobile conveyor apparatus (1) is positioned where at least one of the support means (4) is a travel support means (5) connected to the bridge (2) and being capable of moving the bridge (2) on the ground and a movable conveyor arrangement (6) supported by the bridge (2) and configured for a back and forth movement on at least a portion of the bridge (2) and being configured for interaction with the transport means (3), wherein at least one of the support means is a temporary support means (4) comprising regulation means (8) capable of establishing and removing ground contact.



Mobile conveyor apparatus

The present invention relates to a mobile conveyor apparatus comprising a bridge provided with at least one transport means for conveying material in the longitudinal direction of the bridge and support means extending from the bridge to the ground whereon the mobile conveyor apparatus is positioned, where at least one of the support means is a travel support means connected to the bridge and being capable of moving the bridge on the ground and a movable arrangement supported by the bridge and configured for a back and forth movement on at least a portion of the bridge and being configured for interaction with the transport means. Also, the invention relates to a method of operating a mobile conveyor apparatus.

Mobile conveyor apparatuses of this kind are well-known in the patent literature, for example from US7814599B2 where a mobile bridge conveyor is disclosed. Such conveyors are used for example to convey material from the site of a mining operation to another location where it is stacked. Usually, several bridge sections are connected to form an elongated bridge on top of which a conveyor transports material. Often, also a movable tripper conveyor arrangement is connected and supported by the elongated bridge. This tripper conveyor arrangement which is configured for a movement on the bridge often, besides a tripper, also comprises a cross conveyor arranged perpendicular in relation to the bridge. The tripper ensures that the material transported on the bridge is diverted to the cross conveyor which transports the material to its destination. Such mobile bridge conveyors with a tripper interconnected to a cross conveyor are usually very heavy due to the structural design needed to support the material being transported. For instance, a tripper conveyor arrangement can weigh 100 tons or more. Because of the size and weight of the tripper conveyor arrangement and the movability of same, numerous portions of the frame of the bridge must be configured for these characteristics. Also crawler units, which usually support and move the bridge on the ground, must be sized for these loads. The structural design of the frame of the mobile bridge conveyor must be dimensioned for the situation where the tripper conveyor arrangement is located at mid-span of a

section of the bridge between two crawler units since this is the most extreme situation for the load on the frame of the bridge. This load situation typically requires the frame of the mobile bridge conveyor to have a mass of more than 500 tons. A structural frame of such a weight is very expensive not only due to the actual materials needed for the manufacturing process but also because the crawlers which support as well as move the bridge must also be dimensioned to accommodate such a weight. Furthermore, the cost of handling and shipping equipment increases with the weight and size of equipment.

Earlier attempts to solve the above problems and minimize weight on the structure are known e.g. from US 8,251,199. Historically, a cross conveyor is an integral part of a tripper and therefore both supported by a bridge structure. When the tripper is at mid-span, it is the worst case design condition structurally. In addition to the tripper weight and cross conveyors weight, the tripper usually houses an electrical room, operator cab, cable reel/drum, etc, and is therefore a very heavy machine of even more than 200,000lbs that have to be supported mid-span. The solution provided by US 8,251,199 is to provide a "driven cross conveyor", i.e. a cross-conveyor with driving means for driving supported on the ground, while the cross conveyor moves across the bridge structure. In this way only the tripper structure and pulleys are supported by the bridge structure, which is required for alignment and belt tracking, while everything else off the mobile conveyor machine e.g. the cross conveyor, electrical rooms, operator's cabs, cable reels etc. is supported on the ground. With this solution around 60% of the weight of a standard tripper and cross conveyor may be taken off the supporting bridge and only the weight of the much reduced tripper needs to be supported at mid-span hence reducing the heavier structure and tracks that would be required on the mobile bridge. However, the present invention does not have driving means for supporting the cross conveyor, electrical rooms, operator's cabs, cable reels etc., while the tripper moves across the bridge structure. The invention disclosed in US 8,251,199 may well be used in combination with the present invention, since they are combinable and seeks to solve the problem in completely different ways, with different technical features.

Mobile conveyors are not to be confused with standard fixed floor mounted conveyors like described e.g. in US6659269. Temporary support in fixed floor mounted conveyors may be used to allow reconstruction of the fixed floor mounted conveyor while operating the belt, i.e. to support the belt, not the structure. The purpose of present invention is of a completely different character, since it is applied to a completely different technical field. The invention improves the mobile characteristics a mobile conveyor, which is of course not at all relevant to a standard fixed floor mounted conveyor, which is not mobile.

It is an object of the present invention to provide a mobile conveyor apparatus where the aforementioned disadvantages are significantly reduced.

This is obtained by a mobile conveyor apparatus of the kind mentioned in the introduction, and being characterized in that at least one of the support means is a temporary support means comprising regulation means capable of establishing and removing ground contact.

Hereby it is obtained that the temporary support means can establish ground contact when the mobile conveyor apparatus is stationarily positioned thereby relieving a significant portion of the strain on the frame of the bridge and on the travel support means which are permanently connected to the bridge. This is particularly needed when the movable arrangement supported by the bridge is located at a maximum distance from one of the travel support means since the frame of the bridge as well as the travel support means will experience the worst scenario from the viewpoint of strain. At such locations the temporary support means are provided so that they can thus relieve the strain both on the frame of the bridge and on the travel support means. This means that the frame of the bridge can be designed for a reduced load situation resulting in lesser requirements for the mass of the structural design and thus a lower weight of the bridge. This reduced weight for the bridge will also affect the travel support means so that they can also be dimensioned for a reduced strain situation leading to reduced size and costs. Furthermore, such temporary support means may be manufactured in a very simple way since they are not configured for movement on the ground and therefore will be relatively inexpensive. A lower

weight of the mobile conveyor apparatus will also improve the viability of the equipment in connection with inadequate ground bearing conditions.

5 It is preferred that at least one temporary support means is arranged between two travel support means so that the mid-span between two such travel support means is supported. However, more temporary support means may be used between two travel support means if necessary and advantageous.

10 The temporary support means may in principle have any form and structure as long as they are suitable for acting as supports between the bridge and the ground, with capability to take up the load when the movable conveyor arrangement is moving on the bridge, especially in the situation where the movable conveyor arrangement is furthest away from a travel support means. The temporary supporting means may also in principle have all kinds of
15 regulation means with capability to establish and remove ground contact so long as they are suitable for alternately bringing the means in and out of operation. However, it is preferred that the regulation means comprise support pads and retractable means such as hydraulic actuated cylinders capable of lowering or lifting the support pads to or from the ground. Such cylinders may preferably be
20 mounted in an arrangement on the bridge, preferably on the underside of the bridge. The temporary support means are preferably permanently mounted on the bridge, however, they may be stand-alone units which are not permanently connected to the mobile conveyor apparatus but mounted when the bridge has been moved to its destination.

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The movable arrangement supported by the bridge may be a movable conveyor arrangement comprising a cross conveyor and means, such as a tripper, for directing the material from the transport means to the cross conveyor. The cross conveyor may be independent of the movable conveyor arrangement and may be
30 a stand-alone unit, preferably self-propelled. The movable arrangement can be configured to carry out efficient stacking of piles of material alongside the mobile conveyor apparatus but can also be configured with hoppers for reclamation and

mining systems or being a combined system combining a conveyor arrangement with a hopper.

5 Preferably the travel support means capable of moving the mobile conveyor apparatus comprises a chassis on which the bridge is connected and a travel drive for moving the chassis. In principle, the travel drive may comprise any suitable means, such as wheels or tracks, so long as it is suitable for moving the bridge. However, it is preferred that crawlers are used for this purpose.

10 The invention will now be explained in greater detail with reference to the drawings, being diagrammatical, and where

Fig. 1 shows a side elevation view of a mobile conveyor apparatus according to the invention, and

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Fig. 2a-c show three sectional views of the mobile conveyor apparatus shown in Fig. 1.

In Fig. 1 is shown a mobile conveyor apparatus 1 comprising two bridge sections 20 2a, 2b connected to each other to form an elongated bridge 2 which is substantially horizontally positioned. The bridge 2 may comprise a considerable number of sections, however, only two bridge sections 2a, 2b are shown in the drawing. The bridge sections 2a, 2b comprise a structural frame connected to each other by a joint 10 which allows the mobile conveyor apparatus 1 to follow 25 uneven ground conditions. Mined material is introduced through a hopper 9 to a transport means in form of a belt conveyor 3 which is arranged on the top of the bridge 2 where it transports the material in the longitudinal direction of the bridge 2. A conveyor arrangement 6 with a cross conveyor and a tripper, which directs material from the belt conveyor 3 to the cross conveyor, is supported by the 30 bridge 2 and movably connected to the upper part of the bridge 2. This conveyor arrangement 6 is configured for moving in both directions on the bridge 2 and the cross conveyor has a length and is located at a height that will ensure that a stack of material can be built alongside the mobile conveyor apparatus 1. The

mobile conveyor apparatus 1 is at a number of locations supported both by travel support means 4 in the form of movable crawlers units (see Fig. 2c). These movable crawler units offer permanent support to the bridge 2 and move the bridge 2 from one position to another when required. Furthermore, when stationarily positioned, the bridge 2 at several locations is supported by temporary support means 5 which are mounted on the bridge 2 and comprising regulation means 7 with one or more hydraulic cylinders 8 connected to support pads 9 (see Fig. 2a). In this way the temporary support means 5 establish ground contact when the mobile conveyor apparatus 1 is stationarily positioned thereby relieving a significant portion of the strain on the frame of the bridge 2 and on the travel support means 4 which are permanently connected to the bridge 2. This is particularly needed when the conveyor arrangement 6 supported by the bridge 2 is located at a maximum distance from one of the travel support means 4 since the frame of the bridge 2 as well as the travel support means 4 will experience the worst scenario from the viewpoint of strain. At such locations the temporary support means 5 are provided so that they can thus relieve the strain both on the frame of the bridge 2 and on the travel support means 4. This means that the frame of the bridge 2 can be designed for a reduced load situation resulting in lesser requirements for the mass of the structural design and thus a lower weight of the bridge 2. This reduced weight for the bridge 2 will also affect the travel support means 4 so that they can also be dimensioned for a reduced strain situation leading to reduced size and costs. When the bridge 2 is to be moved, the movable conveyor arrangement 6 is positioned directly over one of the travel support means 4 and subsequently ground contact for the bridge 2 through the temporary support means 5 is inactivated or removed since they are not configured for movement on the ground. As the movable conveyor arrangement 6 is positioned directly over one of the permanent travel support means 4 the load will be taken up by these means which are sized for this load situation. In this way the frame of the bridge 2, which during movements, is not supported by the temporary supporting means 5 does not need to be dimensioned for a scenario, where the conveyor arrangement 6 is located at mid-span between two travel support means 4. Hence, the frame of the bridge 2 can be designed for a reduced load situation resulting in a lower weight of the bridge 2.

In Fig. 2a-c the support means 4, 5 for the mobile conveyor apparatus 1 is shown. Fig. 2a refers to section A-A in Fig. 1 and shows the temporary support means 5 in the situation where the mobile conveyor apparatus 1 is ready to move as the support pad 9 is lifted from the ground by the hydraulic cylinder 8. In this situation the movable conveyor arrangement 6 with the tripper and the cross conveyor will be positioned directly over a travel support means 4 to make sure that the load is taken up by this. Fig. 2b illustrates a situation where the bridge 2 is positioned and ready for operation since the hydraulic cylinder 8 has lowered the support pad 9 to ensure ground support being activated for the bridge 2 in that location. Here the bridge 2 is supported sufficiently to allow the movable conveyor arrangement 6 with the tripper and the cross conveyor to move between the travel support means 4. The hydraulic medium for the hydraulic cylinders is preferably provided from the main hydraulic system for the mobile conveyor apparatus 1. In Fig. 2c, section C-C in Fig. 1, a travel support means 4 connected to the bridge 2 is shown. It offers permanent support for the bridge 2 both when it is moving and when it is in operation and stationarily positioned. The travel support means 4 utilize crawlers to ensure optimum functionality and mobility.

A mobile stacking conveyor as referred to in this application is typically a single conveyor supported on a series of truss frames and crawler tracks. The trusses are connected typically by a special joint that allows the machine to follow uneven ground conditions and relieve stresses that could damage the structure.

A single conveyor belt flight runs along the top chord of the trusses the length of the mobile conveyor. The belt drive is typically located at the end of the machine, since this is normally closest to the electrical power.

The mobile conveyor tripper travels along the top chords of the mobile stacking conveyor. The tripper "trips" ore onto the cross conveyor belt and discharges the material onto the stack. The cross conveyor is long enough for the pile to be built to the design height while keeping the crawler track back from the advancing toe of the pad.

The above description of a mobile conveyor seeks to demonstrate how the technical field of mobile conveyors is very different from conventional overland fixed floor mounted conveyors both in terms of technical challenges and possibilities.

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Although the invention has been described in the above in connection with preferred embodiments of the invention, it will be evident for a person skilled in the art that several modifications are conceivable without departing from the invention as defined by the following claims.

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Claims

1. Mobile conveyor apparatus (1) comprising:

- 5 - a bridge (2) extending in a longitudinal direction and provided with at least one transport means (3) for conveying material in the longitudinal direction of the bridge (2)
- 10 - a movable arrangement (6) supported by the bridge (2) and configured for a back and forth movement in the longitudinal direction of the bridge (2) on at least a portion of the bridge (2) and being configured for interaction with the transport means (3)
- 15 - a plurality of support means (4,5) extending from the bridge (2) to the ground, and where at least one of the support means is a travel support means (4) connected to the bridge (2) and being capable of moving the bridge (2) on the ground, and
- 20 wherein at least one of the support means is a temporary support means (5) comprising regulation means (7), said temporary support means (5) comprising regulation means (7) being capable of establishing and removing ground contact between the bridge (2) and the ground for providing temporary support of the bridge (2) on the ground when the temporary support (5) is in contact with the ground.

2. Mobile conveyor apparatus according to claim 1, wherein at least one temporary support means (5) is arranged between two travel support means (4).

25 3. Mobile conveyor apparatus according to any preceding claims, wherein the regulation means (7) comprises a hydraulic cylinder (8).

30 4. Mobile conveyor apparatus according to any preceding claims, wherein at least one of the temporary support means (5) is mounted on the bridge (2).

5. Mobile conveyor apparatus according to any preceding claims, wherein the movable arrangement (6) comprises a cross conveyor and means for directing the material from the transport means (3) to the cross conveyor.

6. Mobile conveyor apparatus according to any preceding claims, wherein the travel support means (4) comprises crawlers.

5 7. Mobile conveyor apparatus according to any preceding claims, wherein the bridge (2) comprises a number of bridge sections (2a, 2b) connected to each other.

8. Mobile conveyor apparatus according to any preceding claims, wherein the bridge (2) is positioned substantially horizontally.

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9. Mobile conveyor apparatus according to any preceding claims furthermore comprising position control means for automatic control of said regulation means (7) as function of a position of the movable arrangement (6) on the bridge.

15 10. Mobile conveyor apparatus according to any preceding claims furthermore comprising height control means for automatic control of said regulation means (7) as function of a distance between the bridge, the bridge being in substantially horizontal position and the ground.

20 11. Mobile conveyor apparatus according to any preceding claims, wherein the travel support means (4) comprises active travel means and wherein the temporary support means (5) comprises passive travel means and load support means, said passive travel means being capable of supporting at least a part of an unloaded weight of the bridge when the bridge is moved over ground and
25 wherein said load support means being capable of supporting at least a part of a fully loaded weight of the bridge when the bridge is not moved over ground.

11. Mobile conveyor apparatus according to claim 11, wherein the passive travel means comprises a spring loaded wheel preferably a hydraulically spring loaded
30 wheel.

12. Method for operating a mobile conveyor apparatus according to claim 1 wherein the method comprises the steps of inactivating the temporary support

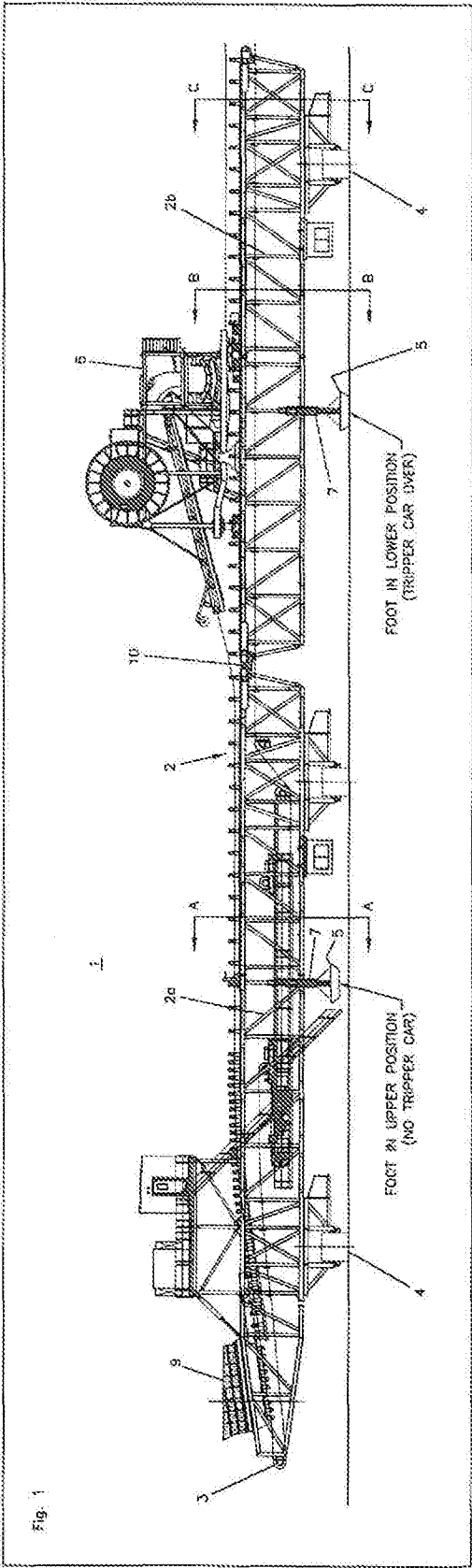
means (5) acting as support for the bridge (2) before the at least one travel support means (4) moves the bridge and activating at least one of the temporary support means (5) to support the bridge (2) after the bridge (2) has been moved to another position.

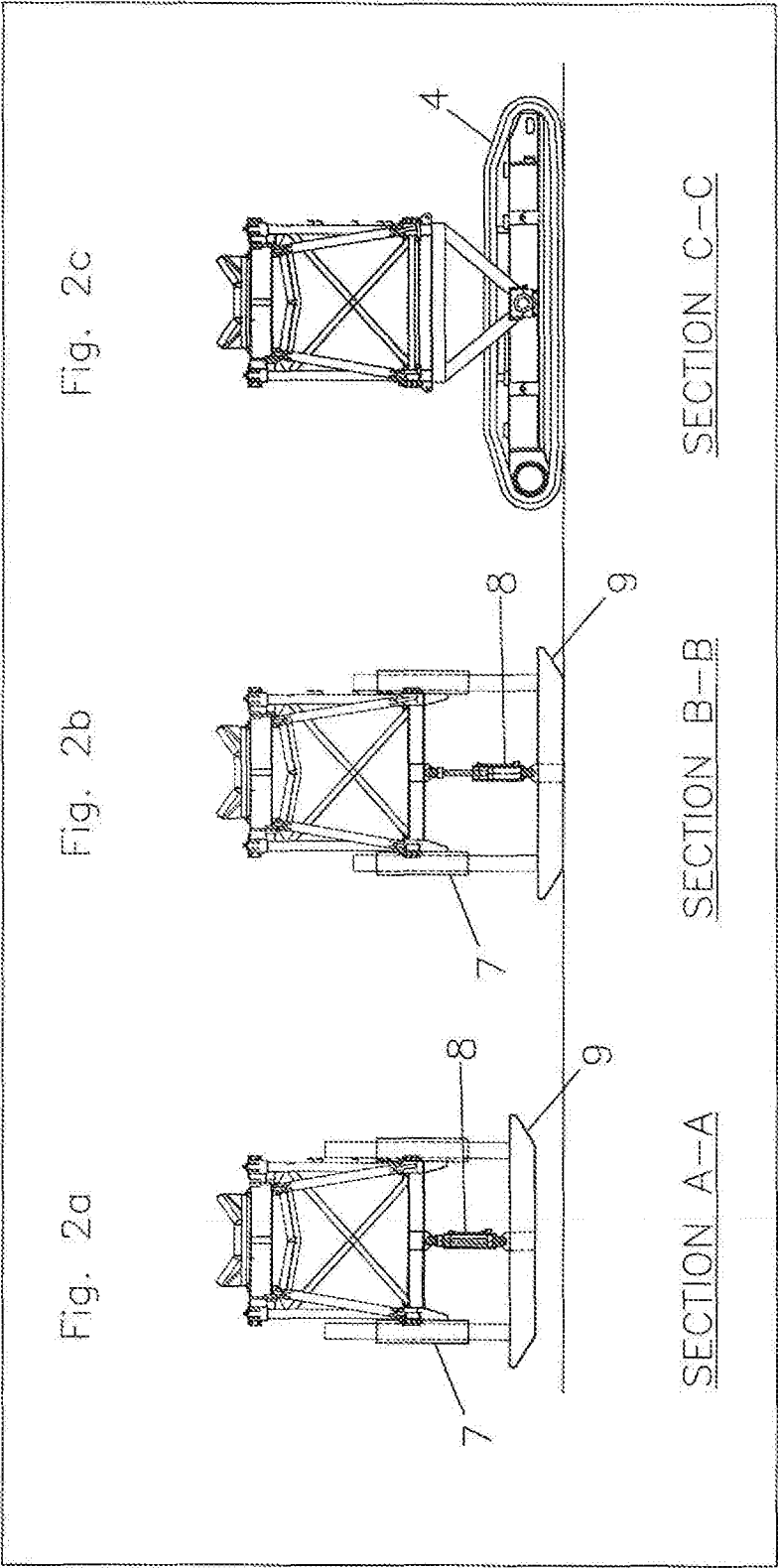
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13. A method of operating a mobile conveyor apparatus comprising the steps of:

- moving a bridge over ground to a predetermined position,
- moving a movable arrangement (6) supported by the bridge (2) back and forth in the longitudinal direction of the bridge (2) while releasing material from transport means (3),
- establishing ground contact between bridge (2) and ground using at least one temporary support means (5) positioned between two neighbouring travel support means (4), when the movable arrangement (6) is moving on the bridge between said two neighbouring travel support means (4), and
- removing ground contact between bridge (2) and ground using the least one temporary support means (5) positioned between the two neighbouring travel support means (4), when the movable arrangement (6) is moving on the bridge away from the portion of the bridge being between said two neighbouring travel support means (4).

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INTERNATIONAL SEARCH REPORT

International application No
PCT/DK2013/050421

A. CLASSIFICATION OF SUBJECT MATTER

INV. B65G41/00 B65G65/28
ADD.

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)
B65G

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)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/136632 A1 (BERNARD GEORGE M [US] ET AL) 24 July 2003 (2003-07-24) paragraph [0039] - paragraph [0045]; figures 1-6	1-14
X	JP S55 35725 A (KUSUMI TSUTOMU) 12 March 1980 (1980-03-12) abstract; figures	1-14
A	EP 0 252 465 A2 (KOCH TRANSPORTTECHNIK GMBH [DE]) 13 January 1988 (1988-01-13) abstract	1
A	JP H07 12324 U (-) 28 February 1995 (1995-02-28) figures	1
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Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

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"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 such documents, such combination being obvious to a person skilled in the art

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INTERNATIONAL SEARCH REPORT

International application No

PCT/DK2013/050421

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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