

BRIDGE PARTS

Description:

The invention concerns bridge parts to be carried on a transport- and installing vehicle with installing equipment, particularly an installing tank for selective construction of short bridges or long bridges.

At the beginning of the seventieth of the 20th century, a flatly installable long bridge of 22m span length has been introduced for the first time, whose two halves could be transported on an installing tank and coupled together fully automatically as a long bridge. By means of the installing equipment of the tank, this long bridge can be shifted freely supported over an obstacle to be overcome, for example a course of a river, and then be installed. Dismantling is possible in the same way.

As a bridge length of 22 m is not necessary for all cases, later a short bridge of 11 m length has been constructed according to the design principle of the long bridge, which can be installed by the same installing equipment. The installing equipment itself has been modified in a way that the installing tank can transport and install either a long bridge or two short bridges.

Soon, a certain deficiency emerged, that in each case before loading of the installing tank it has to be decided whether one long bridge or two short bridges would be applied. Therewith, a fast reaction to changing demands was not possible.

A generic bridge part is known from the EP 0 374 019 A1. The same consists basically of a fixed ramp, a pivoting carriageway panel as top chord of a carcass, and a bottom flange. The carriageway panel is articulated at the fixed ramp by means of a hinge-joint and features a removable ramp forefront, which can be secured with the bottom flange. The movable carriageway panel is erected or respectively lowered by means of a hydraulic cylinder, which is mounted either at the installing vehicle or at the bottom flange. To make this carcass statically defined and operative, the bottom flange is also designed bending resistant.

In case of load, the movable carriageway panel would be stressed with local bending and normal force, irrespective of whether it would be used as short bridge or as part of a long bridge.

At application as a short bridge, that is to say with lowered carriageway panel, the stiffness of the bridge carcass would be achieved only by firm interlocking of the carriageway panel with the bottom flange.

Further bridge part of similar design are known from DE-G 94 12 270 U1 respectively EP 0 391 149 B2. Here too, the bottom flange has to be designed bending resistant, so that the carcass built of a firm ramp element, a movable carriageway panel and a bottom flange, would be statically defined and therefore sustainable.

An other bridge part for building of alternatively short or long bridges by means of an installing vehicle is known from EP 0 916 769B. This bridge part features a single fold-away ramp with a fold-away ramp head and a bottom flange, built by two angular flexible tension booms, which is connected in the area of the fold-away ramp by a cross-bearer to ensure the necessary stability and shape. This ramp extends over half the length of the bridge part. At raised position of the ramp, the ramp head is connected bending resistant with a coupling at the bottom flange. Tension couplings are designed at the free end of the tension booms. For completion of the long bridge, couplings are also designed at the top chord, whereas simple dog clutches will suffice, as only compression forces prevail.

The unbalance of the bridge parts would obstruct the handling. For example, after carrying a short bridge from the opposite side, a long bridge can be installed only after rotating the bridge part by 180° around its vertical axis. The common installing equipment is yet not prepared for that.

It shall be understood, that for moving the bridge parts and the bridges constructed by same, running gears are necessary, consisting of roll sets on the one hand and tracks on the other hand. At many bridge systems the tracks are components of the bridge parts, the roll sets are components of the installing equipment mounted at the installing vehicle.

The tracks are subject to heavy wear. Therefore these bridge parts have to be repaired frequently. Or the track would be made of steel, whereby the weight would be increased. Both alternatives are unsatisfactory.

Yet another common disadvantage of the introduced bridge parts is, that either only one short bridge or only one bi-modular long bridge can be constructed. Thereby the application is explicitly limited.

From EP 0 757 132 B1 a tank bridge with a fold-away cross bearer is common. Stabilising takes place by means of resilient elements. The rollers are mounted at the bridge, the tracks at the installing device.

From EP 0 685 599 B1 an installing system with a movable installing bar is common. Here too, the rollers are mounted at the bridge, the tracks at the installing device.

EP 0 757 131 B1 describes a coupling system for the connection of bridge modules. The rollers are mounted at the bridge, the tracks at the installing device.

The invention at hand is based on the task to indicate bridge parts, which are highly variable regarding their application and, if required, can be coupled in any quantity for construction of a bridge.

These tasks are solved by bridge parts with the following characteristics:

- one base element, dimensioned as bending resistant support with bottom flange and carriageway,
- at least one ramp articulated at the base element, built by a ramp base with a flexibly articulated ramp head,

identified by the following characteristics:

- ramps are articulated at both ends of the base element,
- the ramp base
 - is dimensioned as a bending resistant u-profile or as a closed box support
 - and can be coupled bending resistant by means of couplings, both at raised and at

lowered position

- the ramp head
 - is articulated at the ramp base,
 - builds the ramp in elongated end position together with the ramp base
 - and is positioned on the bottom flange in angled end position,
- the length of the ramp head and the position of the couplings are coordinated in that way, that the ramp base at raised position would build an even carriageway together with the base element,
- tensile couplings are designed at the spare ends of the bottom flanges,
- pressure couplings are designed at the spare ends of the ramp base,
- support elements with carrying rollers are located at the base elements,
- control elements with a control roller are located at the ramp basis,
- the support and control elements cooperate
 - with the installing equipment carried on the vehicle
 - and with an erecting bar designed at the installing equipment.

Favourably, at the bridge system with fold-away ramps according to the invention, at each end, the vertical movement of the ramps would also be applied for the operation of the installing system.

The roll sets are connected at the bridge part, the roll tracks are located at the installing equipment. This is of advantage, as all components which could be subject to wear during the installing process, can be replaced easily. The track ways of the installing equipment which are carried on the installing vehicle, can be designed of wear-resistant steel. The supporting structure of the bridge elements would not be directly strained by wear. The weight of the bridge parts would not be increased.

At construction of a short or long bridge, the guide roll mounted at the ramp base would be brought by partly inclination of the installing equipment at horizontal relocating of the bridge parts or at lowering of same to the track, automatically into the right position respectively below or above the track way of the installing equipment or a specific erection bar which is mounted here, without the necessity of a special control device. The control roller mounted at the ramp base is respectively applied in combination with the

carrying roller arranged at the base element for support of the overhang moments.

Additionally, two topple safeties could be arranged at the base element, which avoid toppling or dislocating of the projecting base element at construction of a long bridge.

According to an advancement of the invention, a dual roll can be mounted below the carrying roller. Thereby, in case of equilibration, this pair of rolls is without function. However, it provides a stable three-point-bearing, which prevents the projecting bridge from swinging. At advance building of the entire bridge, it temporarily takes over the support of the weight moments of the overhanging bridge part. At intermediate positions, it provides an additional support.

Due to the arrangement of the rolls at the bridge part, the bottom flange would not be strained by the supporting force during the installing process. Therefore, a convenient shape regarding space and weight can be chosen.

Advantageously, the hinge between the base element and the ramp basis is a buried arranged, continuous strap hinge.

According to one design of the invention, the base element and the ramp base in the area of the carriageway are dimensioned as compression chord. Thereby, dog clutches are designed at the ends of the compression chord.

According to one design of the invention, the bottom flange is dimensioned as a tension boom, whereas tension couplings are designed at the ends of the tension boom.

For release of the hinges, the ramp head supports itself at raised position as well as at lowered position against the ramp base by means of the pressure surfaces. Thereby it can absorb weight as well as bearing strengths.

Yet another task of the ramp head is to protect the bottom flange couplings in the drive area and the pressure strip of the top chord from contamination and damaging.

Advantageously, the ramp heads and the bottom flanges are coupled with positive locking to stabilise the projecting bottom flanges against lateral forces.

According to an advancement of the invention, inside the bridge part a mechanism is permanently installed, which couples the pivoting of the movable ramp base with the pivoting of the movable ramp head. This characteristic accelerates the installing process, which is of special value at a battle field bridge, and it leads to further reduction of weight of the bridge.

Preferably all heavily stressed components of the bridge part, for example the pressure surfaces, are made of steel, all other components are made of light alloy, preferably of high-strength light alloy.

With the drawing, the invention shall be explained in detail in the form of design examples. Schematically is shown respectively as follows

Fig. 1 a bridge part as short bridge,

Fig. 2 the bridge part of Fig. 1 as centrepiece of a multi-modular long bridge,

Fig. 3 two bridge parts, coupled as a bi-modular long bridge,

Fig. 4 a section of Fig. 1, on enlarged scale,

Fig. 5 a section of Fig. 2, on enlarged scale,

Fig. 6 raising of the ramp base by vertical lowering of the bridge part,

Fig. 7 raising of the ramp base by horizontal relocating of the bridge part and

Fig. 8 the components of an installing vehicle, which are important for installing of the bridge part.

Fig. 1 is showing a short bridge, built by a single bridge part 10. It has a firm base element 1, at whose two ends a ramp is articulated which is built by a ramp base 2 and an articulated ramp head 3. As hinge between base element 1 and ramp base 2, a buried fitted hinge joint is suitable. The length of the ramps 2, 3 is approximately a quarter of the length of the bridge part. Tension booms 1' are placed below the ramps 2, 3 and the base element 1.

In the position depicted in Fig. 1, the ramp bases 2 and the ramp heads 3 are connected bending resistant with the base element 1. Details are clarified by means of Fig. 4. Thereby the bridge part 10 is fully serviceable as a short bridge.

Fig. 2 is showing the bridge part 10 of Fig. 1 reconstructed in a way that it can be inserted as a centre part of a multi-modular bridge. Therefore, the ramp bases 2 are pivoted up until they would build an even carriageway 9 with the firm base element 1, and connected bending resistant with base element 1. The ramp heads 3 are flapped down and arranged on the bottom flanges 1' by means of positive-fitting couplings 15. Thereby the bottom flanges 1' are stabilised against lateral forces. Details are explained by means of Fig. 5.

Fig. 3 is showing a bi-modular long bridge consisting of two bridge parts 10. The ramps 2, 3 at the end sides are flapped down as in Fig. 1. The ramp bases 2 in the centre of the long bridge are pivoted upwards as in Fig. 2 and supported in this position by the flapped down ramp heads 3. Thereby is built a continuous even carriageway 9.

For transmission of the forces between the coupled bridge parts 10, the base elements 1 and the ramp bases 2 in the area of the carriageway 9 are built as compression chords. Furthermore, they are equipped with pressure couplings 4' at the coupling point. In the simplest case, these are positive fitting pressure strips, which transmit not only compressive forces but also transverse forces. The bottom flanges 1' are built as tension booms, and at the junction provided with tension couplings 4. In the simplest case these are dog clutches. Altogether, a sustainable carcass is developed, so that at a bridge length of 26m and suitable dimensioning heavy loads, for example battle tanks of class MLC 70 / 80, can drive on the long bridge.

As shown in Fig. 1 to 3, the bridge parts 10 are equipped with three carrying rollers 5 at the base elements.

Below the carrying rollers 5, two topple safeties 5' are arranged with reciprocal horizontal space to avoid that the short or long bridges which are moved on the installing equipment, would swing uncontrollably. The vertical space between the roll 5 and the topple safety 5' is adjusted to the installing equipment (Fig. 8) which is carried on the installing vehicle. The topple safeties may also be built as rollers.

As also shown in Fig. 1 to 3, respectively one control roller 6 is placed at the one side and at the other side of the ramp bases 2. The control rollers 6 are positioned in a way that at lowered ramp base 2 (Fig. 1) they are located below the track of the installing equipment (Fig. 8), and at raised ramp base 2 (Fig. 2) they are located at the level of the carrying roller 5. This is caused by a horizontal respectively a vertical movement of the bridge part 10 during installing in cooperation with an erection bar A, A' (Fig. 6 resp. Fig. 7 and Fig. 8) designed at the installing equipment. Thereby, during the installing process, the movements of the bridge parts 10 are also applied for adjustment of the requested bridge length, without the necessity of an additional adjusting mechanism. Thereby is achieved, that short bridges as well as long bridges can be mounted and installed with the installing equipment without retrofitting.

Fig. 4 is showing a section from Fig. 1 in enlarged scale. The end of the base element 1 can be seen, at which the ramp base 2 is articulated by means of a hinge 11, preferably a strap hinge. The ramp base 2 is formed as a box-section with a u-shaped cross section. It features two prepared coupling openings 12, 13, so that a bending resistant joint can be made with the base element 1 by means of coupling pins (not depicted).

At the free end of the ramp base 2, by means of a hinge 14, the ramp head is articulated, which is supported at the ramp base 2 in the depicted position, whereas suitable steel-made support surfaces are designed. In this position the ramp base 2 as well as the ramp head 3 can transmit weight to the basis, for example a riverbank.

Fig. 5 is showing a section from Fig. 2 on enlarged scale. The ramp base is pivoted up

and forms together with the base element 1 the continuous even carriageway 9. The ramp base 2 is coupled bending resistant with the base element 1 by the pin opening 12 and an inserted coupling pin (not depicted).

The ramp head 3 is pivoted down and is positioned in a positive fitting coupling 15 on the bottom flange 1'. Due to the positive fitting coupling 15, the ramp head 3 can stabilise the basis against lateral forces.

Fig. 6 is showing a section from Fig. 2 on enlarged scale. The ramp base 2 is erected by the vertical movement (C) of the base element 1. During the vertical movement of the base element 1, the control roller 6 lies down on the erection bar A, designed at the installing equipment (Fig. 8), and thereby erects the ramp base 2.

Fig. 7 is also showing a further section of Fig. 2 on enlarged scale. In this design example, erecting of ramp base 2 takes place by a horizontal movement B of base element 1. During the horizontal movement B, the control roller 6 moves up on the ramp of an erection bar A' of the installing equipment (Fig. 8) and thereby erects the ramp base 2.

Fig. 8 is showing schematically an installing vehicle 20, here in the form of an installing tank. The installing equipment 21 is already driven into the installing position. The bridge part 10 is completely driven up at the installing equipment 21. The control roller 6 is located below the erection bar 22, so that the ramp base 2 and the ramp head 3 are in elongated position and therefore form a drive-up ramp, as depicted in Fig. 1, 3 and 4.

Claims:

1. Bridge part (10), to be carried along on a transport- and installing vehicle (20) with installing equipment (21), in particular an installing tank, for construction of alternatively short bridges or long bridges, basically including

- a base element (1), dimensioned as bending resistant bearing with bottom flange (1') and carriageway (9),
- and at least one ramp articulated at the base element (1), formed by a ramp base (2) with a flexible articulated ramp head (3),

characterised by the following characteristics:

- ramps are articulated at both ends of the base element (1),
- the ramp base (2)
 - is dimensioned as a bending resistant u-profile or as a closed box bearing
 - and in raised position as well as in lowered position to be coupled bending resistant with the base element (1), by means of couplings (12, 13),
- the ramp head (3)
 - is articulated at the ramp base (2),
 - builds the ramp in elongated end-position with the ramp base (2)
 - and is positioned in angled end-position on the bottom flange (1'),
- the length of the ramp head (3) and the position of the couplings (12, 13) are coordinated in a way that, in raised position, the ramp base (2) would build an even carriageway (9) with the base element (1),
- tension couplings (4) are designed at the free ends of the bottom flanges (1'),
- support elements with carrying rollers (5) are located at the base element (1)
- control elements with a control roller (6) are located at the ramp base (2),
- the support- and control elements (5, 6) cooperate
 - with the installing equipment (21) which is carried along on the vehicle (20)
 - and with an erection bar (22) which is designed at the installing equipment (21).

2. Bridge parts according to claim 1, characterised by the following characteristic:

- preferably two topple safeties (5') are placed at the base element (1).

3. Bridge part according to claim 1, characterised by the following characteristic:
 - the support elements (5) at the base element (1) also include double rollers.
4. Bridge part according to claim 1, characterised by the following characteristic:
 - the hinge (11) between the base element (1) and the ramp base (2) is a buried fitted continuous strap hinge.
5. Bridge part according to claim 1, characterised by the following characteristic:
 - in the area of the carriageway (9), the base element (1) and the ramp base (2) are dimensioned as a compression chord.
6. Bridge part according to claim 5, characterised by the following characteristic:
 - positive fitting tension couplings (4') with transverse force transmitting are designed at the compression chord.
7. Bridge part according to claim 1, characterised by the following characteristic:
 - the bottom flange (1') is angular flexible.
8. Bridge part according to claim 1, characterised by the following characteristic:
 - in raised as well as in lowered position, the ramp head (3) is supported by means of pressure surfaces (3') at the ramp base (2).
9. Bridge part according to claim 8, characterised by the following characteristic:
 - a positive fitting coupling (15) is located between the ramp head (3) and the bottom flanges (1').
10. Bridge part according to claim 1, characterised by the following characteristics:
 - the base element (1) is built as u-bearing, opened downwards,
 - the ramp base (2) is built as a box bearing.
11. Bridge part according to claim 1, characterised by the following characteristic:
 - at the installing equipment (21), an erection bar (A) is designed, which erects the ramp base (2) by means of the control roller (6) at a vertical movement (C) of the

base element (1) .

12. Bridge part according to claim 1, characterised by the following characteristic:

- at the installing equipment (21), an aligning rail with a ramp (A') is designed , which erects the ramp base (2) by means of the control roller (6) at a horizontal movement (B) of the base element (1).

13. Bridge part according to one of the claims 1 to 12, characterised by the following characteristics:

- all heavily stressed components are made of steel,
- all other components are made of light alloy.