



BRIDGE CRANE OR GANTRY CRANE COMPRISING A CABLE LENGTH-
ADJUSTING ELEMENT FASTENED TO THE LOAD SUSPENSION MEANS

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Specification

The invention relates to a bridge crane or gantry crane for the handling of standardized cargo holders, especially for the handling of ISO containers and swap bodies between roads and railways, with a crab which can be moved along a crane girder in the direction of travel of the crab, on which a rigid mast is guided that extends in a raising and lowering direction, which can be moved in the raising and lowering direction using at least one lifting gear and cables, the lifting gear being disposed on the crab. A load suspension means for standard cargo holders is rigidly fastened to the lower end of the mast, and the cables from the at least one lifting gear engage with the load suspension means.

A cargo handling device for goods containers, especially containers in railway traffic, is known from German application laid open DE 27 52 212 A1. In one embodiment depicted there, the cargo handling device consists basically of a gantry crane with a crab, from which a telescoping mast is hung. The mast has three telescopic segments. The upper end of the uppermost telescopic segment is rigidly fastened to the crab, while at the lower end of the lowermost telescopic segment is rigidly hung a C-shaped frame. This C-shaped frame with upper horizontal arms and lower horizontal arms is provided

This C-shaped frame with upper horizontal arms and lower horizontal arms is provided so as to be able to move the load suspension means hanging from the lower horizontal arm sideways underneath an overhead line of a railroad section. In order to move the C-shaped frame and the load suspension means in the raising and lowering direction,
5 cables with drums are arranged on the crab, from which a total of four cables run to cable rollers disposed on the top of the horizontal arms.

A bridge crane for the stacking of containers, especially ISO containers, is known from the European patent EP 1 365 984 B1, which moves containers into and/or out from a
10 storage area inside a container terminal. The bridge crane has a crane girder, which spans the width of an essentially cubical storage area. On the crane girder, a crab can travel along its lengthwise direction in the width direction of the storage area. The crane girder can travel on running gears in the direction of travel of the crane and thus transversely to the crab on the crane girder, and also in the lengthwise direction of the
15 storage area. In order to handle the containers, a mast is disposed on the crab, being guided and able to be raised or lowered in the vertical direction. The mast is fashioned as a box girder, and lifting gears are arranged on the crab for the raising and lowering movement of the mast. At the lower end of the mast, pointing in the direction of the containers being handled, a load suspension means for containers, especially a so-called
20 spreader, is hung by a pivot. The load suspension means is connected by cables to the lifting gears on the crab. The mast is not driven directly in the raising and lowering direction, but only indirectly by the cables engaging with the load suspension means. The use of a rigid mast between the crab and the load suspension means brings the

advantage that the container can be handled with little swaying motion, unlike the load suspension means that are also used and hung solely from cables.

Furthermore, a gantry crane for the handling of containers and swap bodies between
5 railway and road is already known from European patent EP 0 796 813 B1. In keeping
with the usual design of a gantry crane, a crab is provided that can travel on a crane
girder in its lengthwise direction, on which are fastened two hydraulic piston-cylinder
units one behind the other looking in the direction of travel of the gantry crane and at a
spacing from each other. The piston-cylinder units are each vertically oriented and
10 consist basically of a lift cylinder and a piston rod moved therein. The lift cylinders are
rigidly fastened to the crab and the piston rods starting from the crab can extend
downward in the lowering direction and be retracted in corresponding manner in the
lifting direction. A hanger frame is fastened to the ends of the piston rods that are
opposite the crab by means of oblong hole connections, and a load suspension means in
15 the form of a spreader frame is hung from this. The connection of the hanger frame by
oblong hole connections to the piston rods was chosen to equalize differences in the
synchronized movement of the piston-cylinder units and any slanted position of the
container. Furthermore, the hanger arm and the load suspension means disposed therein
are offset to the side by at least 500 mm in relation to the lengthwise axis of the two
20 piston-cylinder units so that containers or swap bodies can also be set down by the
gantry crane on a railroad car or picked up from it and at the same time an overhead
guide wire can run underneath due to the sideways offset arrangement of the load
suspension means on the piston rod.

Moreover, another crane layout for handling of containers in railway traffic is known from German patent laid open DE 29 11 938 B2. This crane layout is also designed as a gantry crane, having a crab with a mast guided on it and able to travel in the lifting and lowering direction. At the lower end of this mast is firmly disposed a jib that projects
5 sideways in relation to the lengthwise direction of the mast, on which a load suspension means for the container is hung by means of a rotary connection with a vertical axis of rotation. The mast can be raised and lowered by a cable mechanism, whose cable is attached to the mast in the region of the lower third of the mast. In addition to the rotary connection on the load suspension means, the crab has a rotation device with a circular
10 running track, on which a rotary frame can travel by running wheels about a vertical axis. The mast is hung eccentrically from the rotary frame, and so it can likewise rotate along with the cable mechanism. Thanks to these double rotation capabilities in the area of the load suspension means and the crane crab, when swinging the container in and out underneath a guide wire of an overhead line, the container should not lose its
15 parallel orientation to a railroad car being loaded or unloaded.

Furthermore, the German utility model DE 200 13 245 U1 discloses a mechanism for the handling of containers, which is configured as a half-gantry crane. Here as well there is a mast suspended from a crane crab and able to travel vertically in the raising
20 and lowering direction. At the lower end of the mast, a connection arm is disposed, projecting horizontally and to the side, on which a load suspension means for containers or cargo units is hung, in order to be able to set down and pick up containers sideways on a railroad car underneath a guide wire of an overhead line. Here as well, the mast is

joined to the crane crab by a rotary device. No further information is provided as to how the mast is raised or lowered.

The problem on which the present invention is based is how to optimize a bridge crane
5 or gantry crane with a rigid outrigger for the handling of standard cargo holders, especially ISO containers and swap bodies, between railway and road.

This problem is solved by a bridge crane or gantry crane with the features of claim 1.

Advantageous embodiments of the invention are indicated in claims 2 to 9.

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According to the invention, in a bridge crane or gantry crane for the handling of standard cargo holders, especially for the handling of ISO containers and swap bodies between roads and railways, with a crab which can be moved along a crane girder in the direction of travel of the crab, on which a rigid mast is guided that extends in a raising
15 and lowering direction, which can be moved in the raising and lowering direction using at least one lifting gear and cables, the lifting gear being disposed on the crab, a load suspension means for standard cargo holders being rigidly fastened to the lower end of the mast, and the cables from the at least one lifting gear engage with the load suspension means, an improvement is achieved in that the at least two cables engage at
20 opposite ends of a double arm, which is fastened to the load suspension means about an essentially horizontal pivot axis. This accomplishes a direct flow of force between cables and load suspension means with an equalizing of cable length and the mast serves solely for guiding purposes. Preferably, by rigid mast is meant a single-piece mast and not a telescoping one.

In order to prevent cables from transferring twist to the mast through the rigid attachment of the load suspension means to the mast, for example, on account of unsynchronized movement, at least one cable engages with the load suspension means
5 via a cable length-adjusting element.

Advantageously, the load suspension means consists of a hanger frame and a spreader frame hung from it, the hanger frame being rigidly secured to the lower end of the mast and the cables engage with the hanger frame.

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In one preferred embodiment, the spreader frame and the hanger frame each have a rectangular cross section, they extend by their lengthwise dimension in the direction of travel of the crane, and the lower ends of a total of four cables are fastened in the region of the corners of the hanger frame. Thanks to this, a length adjustment of the cables is
15 accomplished, while at the same time firmly attaching the cables to the hanger frame. In this preferred embodiment, the front two cables and the rear two cables in the direction of travel of the crane are secured to the opposite ends of a double arm, which is mounted on the hanger frame able to pivot at its middle about a pivot axis running in the direction of travel of the crane.

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In order to make possible a handling of standard cargo holders, especially for the handling of ISO containers and swap bodies, between road and railway and this underneath a guide wire of an electrified railroad section, the load suspension means is disposed with a sideways offset from the mast. Since the load suspension means is hung

rigidly from the mast, an especially stable guidance of the load suspension means is achieved, even though the load suspension means stick out to the side relative to the mast.

- 5 Advantageously, the load suspension means is disposed with a sideways offset from the mast in the range of 500 mm to 1500 mm.

An especially stable supporting of the mast in the region of the crane crab is achieved in that the crane girder consists of a first girder and a second girder, on which crab rails are
10 disposed, on which the crane crab can travel in the direction of travel of the crab, and the first girder and the second girder are spaced apart from each other in the direction of travel of the crane, running perpendicular to the direction of travel of the crab.

The possible uses of the bridge crane and gantry crane are expanded in that the mast can
15 turn about a vertical pivot axis relative to the crane crab.

A sample embodiment of the invention is represented in the drawing and shall be described hereafter. There are shown:

- 20 Fig. 1, a view of a handling facility with a bridge crane or gantry crane according to the invention, configured as a gantry crane,

Fig. 2, a side view of Fig. 1,

Fig. 3, an enlarged feature from Fig. 1 from the region of a load suspension means,

Fig. 4, an enlarged feature (partly in sectional view) from Fig. 1 from the region of a rotary connection, and

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Fig. 5, a top view of the load suspension means of Fig. 3.

Figure 1 shows a view of a handling facility 1 for standard cargo holders 2, such as ISO containers and swap bodies, between road and railway. The handling facility 1 basically
10 consists of a railway handling zone 3, a road handling zone 4, and a bridge or gantry crane 5 configured as a gantry crane.

The railway handling zone 3 basically consists of a first track section 3a and, running parallel with this at a spacing, a second track section 3b. Between the first and second
15 track sections 3a and 3b, each running straight in the railway handling zone, a plurality of railway poles 3c are disposed in usual fashion, each carrying a guide wire 3d above the first and second track sections 3a, 3b. Railroad cars 6 can move along the first and second track sections 3a and 3b for loading and unloading of the standard cargo holders 2.

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The road handling zone 4 is disposed to border the second track section 3b at the side.

In the present case, this road handling zone 4 consists essentially of support racks 4a on which the standard cargo holders 2 unloaded from the railroad cars 6 can be set down

for interim storage. Then the standard cargo holders 2 can be loaded further onto trucks (not shown) from the cargo holders 2.

The railway handling zone 3 and the road handling zone 4 are each situated in the range
5 of the bridge or gantry crane 5, which spans these two handling zones 3 and 4.

This bridge or gantry crane 5 consists essentially of a crane girder 8 which can travel on rails 7 in the direction of travel of the crane F (see Fig. 2) along the first and second track sections 3a, 3b. A crane crab 9 can travel on the crane girder 8, transversely to the
10 direction of travel F of the crane girder 8, in the direction of travel of the crab K. From the crab 9 is hung a mast 10, which can be raised and lowered vertically and relatively to the crab 9, in order to pick up and set down standard cargo holders 2 by means of a load suspension means 11 secured to its lower end 10a. The load suspension means 11 is divided into a hanger frame 11a, which is firmly secured to the lower end 10a of the
15 mast 10, and a spreader frame 11b, which is hung by chains 11c from the hanger frame 11a. The hanger frame 11a projects sideways in relation to the mast 10. The rigid mast 10 here is preferably a single piece and not telescopic. This rigid mast 10 thus affords an especially stable guidance of the load suspension means.

20 The crane girder 8 is supported at its opposite ends by right and left vertical supports 12l and 12r, looking in the direction of travel of the crane F. As a whole, the bridge or gantry crane 5 is U-shaped and open at the bottom, looking in the direction of travel of the crane F. The vertical supports 12l and 12r receive the crane girder 8 at their upper

ends, at its opposite end regions, and at their lower ends they can travel by crane running gears 13 on the rails 7 in the direction of travel of the crane F.

The crane crab 9 consists essentially of a rectangular base frame 9a, at the four corners
5 of which crab running gears 14 are disposed, which travel on crab rails 15 disposed on the crane girder 12. In the base frame 9a of the crab 9, in the middle area, there is an opening through which a rotary pipe 16 is led. The rotary pipe 16 is supported at its upper end 16a on the base frame 9a of the crab 9 by a rotary connection 16b and can turn about a vertical pivot axis D by the rotary connection 16a. The mast 10 runs inside
10 the rotary pipe 16 and is guided there.

Figure 2 shows a side view of Fig. 1. As can be seen, the crane girder 8 is fashioned as a double girder with a first girder 8a and a second girder 8b, which are arranged on the same height level and at a distance behind each other, looking in the direction of crane
15 travel F. Accordingly, the left vertical support 12l and the right vertical support 12r are also fashioned as double supports looking in the direction of travel of the crane F, being joined to each other in the region of their lower end by a base girder 12a in U-shaped manner.

20 Figure 2 also shows that the first girder 8a and the second girder 8b each have a triangular cross section. This triangular cross section has the form of an equilateral triangle, the angle in the region of the vertex 8c being around 30° . The crab rail 15 on which the crab 9 can travel in the direction of travel of the crab K is secured each time in the region of the vertices 8c of the first girder 8a and the second girder 8b.

Figure 2 makes especially clear the rotary connection 16a and the rotary pipe 16. To drive the rotary pipe 16, a toothed collar 16d is provided around its outside, which engages with an electric motorized rotary drive 16e, which is supported on the base frame 9a. In order to move the mast 10 in the raising and lowering direction H, a rectangular lifting frame 17 is rigidly fastened to a lower end 16c of the rotary pipe 11. A lifting gear 18 for the mast 10 is arranged on the lifting frame 17 of the crane crab 9. The lifting gear 18 has a first cable drum 18a and a second cable drum (not shown), mounted coaxially to each other on a shared gearing 18b, which is actuated by a drive motor 18c. A first cable 19a and a second cable 19b run off from the first cable drum 18a. A third cable 19c and a fourth cable 19d run off from the second cable drum 18b. Accordingly, there are four cables present 19a, 19b, 19c, 19d, which either run off directly from the first or second cable drum 18a, 18b vertically downward or are led horizontally to the opposite side of the mast 10 and there deflected 90° vertically downward by a deflection roller 20 with a horizontal axis of rotation. The ends of the cables 19a, 19b, 19c, 19d are connected to [the] hanger frame 11a.

Figure 2 also shows that a container-type holder 21 is fastened on the outside of the second girder 8b, in which the controls and the electrical or electronic power pack for the bridge or gantry crane 5 is arranged.

Figure 3 shows a magnified feature of Fig. 1 from the region of the load suspension means 11 and shows especially well the rigid and central fastening of the hanger frame 11a to the lower end 10a of the mast. The hanger frame 11a looking in top view has an

essentially rectangular cross section. The four cables 19a, 19b, 19c, 19d are attached to the respective corners of the hanger frame 11a. The spreader frame 11b is typically hung by chains 11c from the hanger frame 11a.

- 5 It is also evident from Fig. 3 that the hanger frame 11a, which is firmly joined to the lower end 10a of the mast 10, is fashioned in the style of a jib and juts out sideways in relation to the axis of rotation D of the mast 10 and thus also projects sideways beyond the contour of the mast 10. In relation to the center line M running through the middle of the points of suspension of the chains 11c for the spreader frame 11b - each time
- 10 looking in the lengthwise direction of the standard cargo holder 2 - the hanger frame 11a is displaced sideways by the offset V from the axis of rotation D, running in the lengthwise direction of the mast 10. The side offset V is in the range of 800 mm to 1500 mm. In the present sample embodiment, it is around 1000 mm, since the guide wire 3d has been attached with a displacement in the range of the permitted tolerance inward
- 15 toward the railway pole 3c. But the guide wire 3d still remains here easily reachable by the current collectors of a train.

- Furthermore, Fig. 3 shows another peculiarity in regard to the articulation of the first cable 19a and the second cable 19b to the hanger frame 11a. This connection can pivot
- 20 about a horizontally running pivot axis S by means of a double arm 22. The arrangement of the first and second cables 19a, 19b across the double arm 22 on the hanger frame 11a has the benefit that differences in synchronized running of the cables 19a, 19b, 19c, 19d as they are wound up and paid out can be equalized in this way and do not lead to twisting in the hanger frame 11a or the lifting frame 17. A second double

arm 22 is provided accordingly for the third and fourth cables 19c and 19d at the opposite end of the hanger frame 11a. The pivot axes S of the first double arm and the second double arm 22 are coaxially oriented.

5 Figure 4 shows an enlarged feature of the bridge or gantry crane 5 according to Fig. 1 from the region of the crane crab 9. It is especially evident from this sectional view that the mast 10 is guided by lower guide elements 23a in the region of the lower end 16c of the rotary pipe 16 and by upper guide elements 23b in the region of the upper end 16b of the rotary pipe 16. The lower and upper guide elements 23a and 23b are configured
10 as guide rollers, which guide the mast 10 on four sides and opposite each other.

Figure 5 shows a top view of the load suspension means 11 according to Fig. 3. For better visibility, the mast 10 is not mounted, so that one only sees a connection element in the form of a flange with screw holes on the hanger frame 11a in the middle.

15 Accordingly, the lower end 10a of the mast 10 is also provided with an encircling flange so that the hanger frame 11a can be screwed rigidly to the lower end 10a of the mast 10. Due to the shape of the connection element 24, one can see that the mast 10 has a slightly oblong hexagonal cross section.

20 In order to absorb the forces arising from the sideways unloaded suspension of the spreader frame 11b on the hanger frame 11a, the hanger frame next to the lower end 10a of the mast 10 is formed as a massive platelike or reinforced boxlike structure, being essentially rectangular when seen in top view while, starting from the connection element 24, the width of the hanger frame 11a decreases in linear manner outward, in

accordance with the strain. In the region of the ends of the hanger frame 11a, two rectangular and boxlike hanger arms 11d are arranged so that the hanger frame 11 in top view has a somewhat U-shaped or forklike appearance. The hanger arms 11d extend at right angles from the hanger frame 11a and at their ends and underside are situated the attachment points for the chains 11c to hang the spreader frame 11b.

It is furthermore evident from Fig. 5 that, due to the special configuration of the hanger frame 11a with its sideways protruding hanger arms 11d, it is possible to hang the spreader frame 11b with the chains 11c displaced sideways by an offset V between the central lengthwise direction L of the spreader frame 11c and the pivot axis D.

It is also evident from Fig. 5 that the two double arms 22 are fastened to the hanger frame 11a so that they can tilt upward about a pivot axis S at their middle. The imaginary extensions of the pivot axes S intersect the pivot axis D of the mast. At the respective opposite ends of the double arms 22 are attached the first cable 19a, the second cable 19b, the third cable 19c and the fourth cable 19d. Thus, the lift forces of the lifting gear 18 are guided centrally into the hanger frame 11a in relation to the pivot axis D. Moreover, it is evident that the double arms 22 run basically parallel to the hanger arms 11d and thus the lift forces of the lifting gear 18 act directly in the region of the chains 11c that carry the spreader frame 11b. Thus, the lift forces are guided almost directly by the hanger arms 11d into the first to fourth cables 19a to 19d, with the exception of the sideways protrusion. Seen in relation to the lengthwise direction L of the spreader frame 11b, the double arms 22 and the hanger arms 11d are basically at the same height.

The specification pertains to a bridge or gantry crane 5, configured as a gantry crane.

Basically it is also possible to configure the bridge or gantry crane 9, 9' as a bridge crane with elevated or spandrel-braced rails 7 or as a half-gantry crane.

List of reference numbers

	1	handling facility
	2	standard cargo holder
5	3	railway handling zone
	3a	first track section
	3b	second track section
	3c	railway pole
	3d	guide wire
10	4	road handling zone
	4a	support rack
	5	bridge or gantry crane
	6	railroad car
	7	rails
15	8	crane girder
	8a	first girder
	8b	second girder
	8c	vertex
	9	crane crab
20	9a	base frame
	10	mast
	10a	lower end of the mast
	11	load suspension means
	11a	hanger frame

- 11b spreader frame
- 11c chain
- 11d hanger arm
- 12a base girder
- 5 12l left vertical support
- 12r right vertical support
- 13 crane running gears
- 14 crab running gears
- 15 crab rails
- 10 16 rotary pipe
- 16a rotary connection
- 16b upper end
- 16c lower end
- 16d toothed collar
- 15 16e rotary drive
- 17 lifting frame
- 18 lifting gear
- 18a first cable drum
- 18b gearing
- 20 18c drive motor
- 19a first cable
- 19b second cable
- 19c third cable
- 19d fourth cable

	20	deflection roller
	21	holder
	22	double arm
	23a	lower guide elements
5	23b	upper guide elements
	24	connection element
	D	vertical pivot axis
	F	direction of travel of the crane
10	H	raising and lowering direction
	K	direction of travel of the crab
	L	lengthwise direction
	M	center line
	S	pivot axis
15	V	offset

Patent claims

1. Bridge crane or gantry crane for the handling of standard cargo holders, especially for
5 the handling of ISO containers and swap bodies between roads and railways, with a crab
which can be moved along a crane girder in the direction of travel of the crab, on which
a rigid mast is guided that extends in a raising and lowering direction, which can be
moved in the raising and lowering direction using at least one lifting gear and cables,
the lifting gear being disposed on the crab, a load suspension means for standard cargo
10 holders being rigidly fastened to the lower end of the mast, and the cables (19a, 19b,
19c, 19d) from the at least one lifting gear (18) engage with the load suspension means
(11), characterized in that at least two cables (19a, 19b, 19c, 19d) are provided and the
at least two cables (19a, 19b, 19c, 19d) engage at opposite ends of a double arm (22),
which is fastened to the load suspension means (11) about an essentially horizontal
15 pivot axis (S).

2. Bridge crane or gantry crane according to claim 1, characterized in that at least one
cable (19a, 19b, 19c, 19d) engages with the load suspension means (11) via a cable
length-adjusting element.

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3. Bridge crane or gantry crane according to claim 1 or 2, characterized in that the load
suspension means (11) consists of a hanger frame (11a) and a spreader frame (11b)
hung from it, the hanger frame (11a) being rigidly secured to the lower end (10a) of the
mast (10) and the cables (19a, 19b, 19c, 19d) engage with the hanger frame (11a).

4. Bridge crane or gantry crane according to claim 3, characterized in that the spreader frame (11b) and the hanger frame (11a) each have a rectangular cross section, they extend by their lengthwise dimension in the direction of travel of the crane (F), and the lower ends of a total of four cables (19a, 19b, 19c, 19d) are fastened in the region of the corners of the hanger frame (11a).

5. Bridge crane or gantry crane according to claim 4, characterized in that the front two cables (19a, 19b) and the rear two cables (19c, 19d) in the direction of travel of the crane (F) are secured to the opposite ends of a double arm (22), which is mounted on the hanger frame (11a) able to pivot at its middle about a pivot axis (S) running in the direction of travel of the crane (F).

6. Bridge crane or gantry crane according to one of claims 1 to 5, characterized in that the load suspension means (11) is disposed with a sideways offset from the mast (10).

7. Bridge crane or gantry crane according to claim 6, characterized in that the load suspension means (11) is disposed with a sideways offset (V) from the mast (10) in the range of 500 mm to 1500 mm.

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8. Bridge crane or gantry crane according to one of claims 1 to 7, characterized in that the crane girder (8) consists of a first girder (8a) and a second girder (8b), on which crab rails (15) are disposed, on which the crane crab (9) can travel in the direction of travel of the crab (K), and the first girder (8a) and the second girder (8b) are spaced apart from

each other in the direction of travel of the crane (F), running perpendicular to the direction of travel of the crab (K).

9. Bridge crane or gantry crane according to one of claims 1 to 8, characterized in that
- 5 the mast (10) can turn about a vertical pivot axis (D) relative to the crane crab (9).