

Bridge or gantry crane, in particular for handling ISO containers.

Description

- 5 The invention relates to a bridge or gantry crane, in particular for handling ISO containers, having a crane trolley which can be moved along a crane carrier in the trolley travel direction and which supports at least one mast which can be moved in a vertical raising and lowering direction and on which a load-receiving means for containers is suspended.
- 10 From European patent EP 1 365 984 B1 a bridge or gantry crane is known for stacking containers, in particular ISO containers, which, within a container terminal, places containers into storage in a storage area or removes them from storage therein. Within the storage area the containers are set down on a rectangular store floor in rows and columns and up to four containers are stacked one on top of another. Within the storage area the set-down containers
- 15 have their longitudinal extension aligned with the longitudinal direction of the storage area and, for example, ten containers are set down next to each other across the width of the storage area and narrowly spaced apart from each other. The bridge or gantry crane has a crane carrier which substantially spans the cuboidal storage area widthwise, on which crane carrier and in the longitudinal direction thereof a crane trolley can travel. When the bridge or gantry crane is
- 20 formed as a bridge crane, the crane carrier has, on each of its opposite ends, at least one running gear, by means of which the crane carrier can travel along rails. In accordance with the construction of a bridge crane the rails are elevated for this purpose by means of vertical supports which are disposed laterally next to the storage area and are anchored in the floor. The bridge crane is therefore able to travel in the longitudinal direction of the storage area by means
- 25 of the running gears of the crane carrier and is able to travel transverse thereto by means of the crane trolley which can travel on the crane carrier. When the bridge or gantry crane is formed as a gantry crane, the rails for the crane carrier are disposed on the floor laterally adjoining the storage area and the running gears of the crane carrier are connected to the ends of the crane carrier via vertical supports.

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In order to be able to handle the containers by means of the crane trolley, the crane trolley is

provided which a mast which can be raised or lowered and is guided in the vertical direction. The mast is formed as a box girder and hoisting mechanisms are arranged on the crane trolley for the raising and lowering movement of the mast. A load-receiving means for containers, in particular a so-called spreader, is suspended on the lower end of the mast which is oriented in the direction of the containers to be handled. The use of a rigid mast between the crane trolley and the load-receiving means is advantageous in that it is possible to handle the containers with a low level of swinging in contrast to load-receiving means which are also used suspended on cables.

From European patent application EP 1 939 131 A2 a container bridge with a crane trolley is also already known, which crane trolley has two cable-winding mechanisms one behind the other when seen in the trolley travel direction, on which cable-winding mechanisms a twin load-receiving means for two ISO containers is suspended by hoisting cables. The individual load-receiving means, however, are connected to each other via hydraulic cylinders, which are oriented substantially horizontally and in the trolley travel direction, in order to be able to adjust the spacing between the individual load-receiving means. In a corresponding manner the load-receiving means cannot be moved independently of each other in the hoisting and steering direction.

Furthermore, the patent document US 5 718 550 A discloses a gantry crane for handling containers, which in a conventional manner has a horizontal crane carrier which carries a first crane trolley and a second crane trolley in front of, or behind, it as seen in the trolley travel direction. Each of the two crane trolleys has a hoisting mechanism on which a spreader frame is attached via cables in order to receive the containers to be handled. These spreader frames are formed in such a way that they can transport two or three containers at the same time in order thereby to increase the handling capacity. The first crane trolley and the second crane trolley each therefore support only a single load-receiving means, which is suspended via cables on a single hoisting mechanism, and are able to travel along the crane carrier independently of each other.

The object of the present invention is to optimise the handling capacity of a bridge or gantry crane.

This object is achieved by a bridge or gantry crane having the features of claim 1.

Advantageous embodiments of the invention are given in claims 2 to 7.

In accordance with the invention in the case of a bridge or gantry crane, in particular for handling ISO containers, having a crane trolley which can be moved along a crane carrier in the trolley travel direction and which supports at least one mast which can be moved in a vertical raising and lowering direction and on which a load-receiving means for containers is suspended, optimisation of the handling capacity is achieved in that at least one second mast with a second load-receiving means is disposed behind and spaced apart from a first mast when seen in the

trolley travel direction. Therefore two containers can be transported with one travelling movement of the crane trolley along the crane carrier. A common crane trolley is advantageously provided.

- 5 In an advantageous manner provision is made for the first mast and the at least one second mast to be spaced apart from each other in such a way that respective containers can be handled independently of each other in relation to the movement in the raising and lowering direction by the first load-receiving means disposed on the first mast and by the second load-receiving means disposed on the at least one second mast. In this way the containers can be handled in
- 10 synchronism or in succession or one of the two masts can remain in a raised inoperative position. Travelling movements of the crane trolley to align the load-receiving means in relation to the containers between the individual handling processes are also possible.

- In constructional terms provision is made so that the first mast can be raised and lowered via a
- 15 first hoisting mechanism and that the at least one second mast can be raised and lowered via a second hoisting mechanism. Provision is also made for the first and second mast to be guided via first upper and lower guide elements and via second upper and lower guide elements respectively on the crane trolley.

- 20 It is also advantageous that the crane carrier consists of a first carrier and a second carrier, on which trolley rails are disposed on which the crane trolley is able to travel in the trolley travel direction, and the first carrier and the second carrier are spaced apart from each other in the crane travel direction which is at right angles to the trolley travel direction.

- 25 In a preferred embodiment a first mast and a second mast are disposed on a common crane trolley. The existence of two masts permits an increase in the handling capacity while at the same time leading to only a small increase in the construction width of the bridge and gantry crane when seen in the longitudinal direction of the container store.

- 30 In order effectively to minimise or prevent lateral swinging of the containers, the first mast and the second mast are each formed of one piece and are rigid. A telescoping mast is not deemed

to be "of one piece" in the sense of this definition as a number of telescope sections are provided.

5 An exemplified embodiment of the invention is described hereinunder and illustrated in the drawing in which:

Figure 1 is an overview plan of a handling installation for ISO containers in a port area,

10 Figure 2 is an enlarged section of Figure 1 from the region of a loading and unloading area of a container store of the handling installation in accordance with Figure 1,

Figure 3 is a perspective view of a bridge or gantry crane in accordance with the invention as shown in Figure 2 when formed as a gantry crane,

15 Figure 4 is a side view of Figure 3,

Figure 5 is a front view of Figure 3 with a neighbouring further bridge or gantry crane,

20 Figure 6 is a front view of Figure 3 with a bridge or gantry crane having a crane carrier of an alternative length,

Figure 7 is an enlarged section of Figure 1 from the region of an area of the handling installation where containers are placed into storage and removed from storage as shown in Figure 1, and

25 Figure 8 is a cross-sectional view of a bridge or gantry crane as shown in Figure 5 seen from the region of the crane trolley.

30 Figure 1 shows an overview plan of a handling installation 1 in a port area in which containers 2, in particular ISO containers, are handled. The overview plan shows only a section of the handling installation 1 but the essential components thereof can be seen. The handling installation 1 consists of a land-side handling area 3, a container store 4 and a water-side

handling area 5.

The land-side handling area 3 adjoins a land-side end 4a of the container store 4 and has an adjoining loading and unloading area 6 with a plurality of parking spaces 7 disposed next to each other for lorries 8 which are to be loaded and unloaded. In the loading and unloading area 6 a lorry 8 parked in one of the parking spaces 7 is loaded and/or unloaded by a bridge or gantry crane 9 operating in the container store 4.

The container store 4 consists of a plurality of container store areas 4c, which are disposed in rows and in parallel next to each other, to which respectively at their land-side end 4a a loading and unloading area 6 is allocated and at their water-side end 4b an area 10 is allocated where containers are placed into and removed from storage. Each container store area 4c is allocated one or a plurality of bridge or gantry cranes 9 which can travel along the container store areas 4c on rails 11 in the crane travel direction F. The containers 2 are transported by the bridge or gantry crane 9 between the container store area 4c and the loading and unloading area 6 or the area 10 where containers are placed into and removed from storage. In addition to the one or the plurality of bridge or gantry cranes 9, each container store area 4c also has a set-down area 4d for the containers 2. The set-down area 4d has a rectangular base surface on which the containers 2 are disposed in rows and columns. In this case up to five containers 2 are stored stacked one on top of the other. The set-down containers 2 are oriented with their longitudinal extension essentially in parallel with the rails 11 and therefore in the crane travel direction F of the bridge or gantry cranes 9. This orientation of the containers 2 is also found in the loading and unloading area 6 with the incoming and outgoing lorries 7 and in the area 10 where containers are placed into and removed from storage so that the respective bridge or gantry cranes 9 do not have to pivot the containers 2 apart from any necessary alignment corrections during pick-up and put-down.

At the water-side end 4b of the container store 4 the containers 2 are set down by the bridge or gantry crane 9 in the area 10 where containers are placed into and removed from storage, or are picked up therefrom. The area 10 where containers are placed into and removed from storage serves as an interface with respect to the water-side handling area 5.

Figure 2 shows an enlarged section of Figure 1 from the region of the loading and unloading area 6 and a part of an adjoining container store area 4c. It is clear that in each loading and unloading area 6 a plurality of parking spaces 7 for lorries 8 are disposed next to each other and with the smallest possible spacing with respect to each other. In a storage area 4c with nine rows of containers 2 set down next to each other, six parking spaces 7 for lorries 8 are provided next to each other.

The more detailed structure of the bridge or gantry crane 9 *per se* is also clear from Figure 2. This bridge or gantry crane 9 consists essentially of a crane carrier 12 which can travel in the crane travel direction F along the rails 11 which are disposed laterally next to the set-down areas 4d of the respective container store area 4c, on which crane carrier a crane trolley 13 can travel in the trolley travel direction K transverse to the travel direction F of the crane carrier 12. A first mast 14 and a second mast 15 are disposed in a mutually spaced manner on the crane trolley 13 one behind the other when seen in the trolley travel direction K. The first and the second mast 14, 15 are therefore suspended on a common crane trolley 13 and are therefore moved jointly along the crane carrier 12 by the crane trolley 13. Each of the two masts 14, 15 can be raised and lowered vertically and with respect to the crane trolley 13 in order to pick up and put down containers 2 by load-receiving means 16, 17 - preferably a spreader frame - attached to the lower end 14a, 15a thereof (see Figure 3). The first and second mast 14, 15 are formed as rigid one-piece jibs, preferably in the form of box girders by means of which the load-receiving means 16, 17 are guided relative to the crane trolley 13. In this way lateral, i.e. horizontal, swinging movements of the load-receiving means 16, 17 with or without containers 2 are minimised or prevented. The first and second mast 14, 15 cannot be telescoped since the lateral stability would be diminished owing to the additional guides between the individual telescope sections then provided.

Figure 3 shows a perspective view of a bridge or gantry crane 9 in accordance with the invention in an embodiment as a gantry crane. For reasons of clarity the container store area 4c is shown empty. The gantry crane 9 has a crane carrier 12, the opposite ends of which are supported via vertical supports 18l and 18r on the right and left when seen in the crane travel

direction F. As a whole the gantry crane is u-shaped when seen in the crane travel direction F and is open towards the bottom. The vertical supports 18l and 18r receive at their upper ends the crane carrier 12 in the opposite end regions thereof and are able to travel at their lower ends via crane running gears 19 on the rails 11 in the crane travel direction F. Furthermore, the crane carrier 12 is formed as a double carrier with a first carrier 12a and a second carrier 12b, which are disposed one behind the other when seen in the crane travel direction F and are disposed spaced apart one behind the other and at the same height. In a corresponding manner the left vertical support 18l and the right vertical support 18r are also formed as double supports when seen in the crane travel direction F, which double supports are connected to each other by a base carrier 18a in the region of their lower end so as to form a u shape. The vertical supports 18l and 18r and the base carrier 18a which altogether form a u shape are additionally braced via rod-like main tensioning elements 18b. The main tensioning elements 18b are disposed in a cross-shape and are each disposed in the region of the upper and lower end on the left vertical supports 18l and the right supports 18r. An upper tensioning element 18c, which extends in parallel with the base carrier 18a and therefore substantially horizontally, is additionally provided above the cross-shaped main tensioning elements 18b.

Figure 3 also shows that the first carrier 12a and the second carrier 12b each have a triangular cross-section. This triangular cross-section is in the shape of an isosceles triangle, wherein the angle in the region of the peak is about 30° . In the region of the peak 12c of the first carrier 12a and of the second carrier 12b a trolley rail 20 is attached in each case on which the crane trolley 13 can travel in the trolley travel direction K.

When seen in plan view the trolley 13 consists essentially of a rectangular base frame 13a, in the four corners of which trolley running gears 21 are disposed which travel on the trolley rails 20. In the middle region of the base frame 13a of the crane trolley 13 are two openings through which the first mast 14 and the second mast 15 are guided. The first mast 14 and the second mast 15 are each guided via lower guide elements 32a into the base frame 13a (see Figure 8). In addition, a table-like support structure 23 is positioned on the base frame 13, which structure is rectangular when seen in plan view and has an upper frame 21a which is supported on the upper side of the base frame 13 via six legs 23b. Upper guide elements 32b for the first mast 14 and

the second mast 15 are located in the region of the upper frame 21a of the carrier structure 23 (see Figure 8).

5 In order to move the first mast 14 and the second mast 15 in the raising and lowering direction H, a first hoisting mechanism 25 for the first mast 14 and a second hoisting mechanism 26 for the second mast 15 are disposed on the base frame 13a of the crane trolley 13. In a corresponding manner the first and second mast 14, 15 can be moved in the raising and lowering direction H in a mutually independent manner. In Figure 3 the first mast 14 is shown in its raised position. In contrast, the second mast 15 is located in a middle position. In this way the
10 first hoisting mechanism 25 and the second hoisting mechanism 26 are disposed on opposite sides of the base frame 13a. The first hoisting mechanism 25 and also the second hoisting mechanism 26 respectively have a first cable drum 25a, 26a and a second cable drum 25b, 26b which are mounted coaxial to one another and on a common first transmission 25c and second transmission 26c, which are driven by a first drive motor 25d and a second drive motor 26d
15 respectively. Each of the four cable drums 25a, 25b, 26a and 26b has running from it in each case two first cables 27 and two second cables 28 so that four cables 27, 28 are provided per hoisting mechanism 25, 26 and either run directly from the cable drum 25a, 25b, 26a, 26b vertically downwards or are guided horizontally onto the opposite side of the first mast 14 and a second mast 15 and from there are deflected 90° vertically downwards via a deflecting roller 29
20 with a horizontal axis of rotation. The ends of the first cable 27 are connected to the first load-receiving means 16 and the ends of the second cable 28 are connected to the second load-receiving means 17.

Furthermore, Figure 3 shows that on the outside of the left vertical supports 18l a container-like
25 housing 30 is attached in which the control and power electrics or electronics for the bridge or gantry crane 9 are disposed.

Figure 4 shows a side view of Figure 3 and illustrates particularly well the universal attachment of the first load-receiving means 16 at the lower end 14a of the first mast 14 and of the second
30 load-receiving means 17 at the lower end 15a of the second mast 15. The first load-receiving means 16 and the second load-receiving means 17 are distributed in the usual way in an upper

first suspension frame 16a and an upper second suspension frame 17a and the actual first spreader frame 16a and second spreader frame 17a. The first suspension frame 16a and the second suspension frame 17a are each universally attached centrally on the upper end 14a of the first mast 14 and the lower end 15a of the second mast 15 and, when seen in plan view, have an essentially rectangular cross-section. In the respective corners of the first suspension frame 16a and of the second suspension frame 17a the four first cables 27 and the four second cables 28 are attached. For reasons of clarity the second cables 28 have been omitted.

Figure 4 clearly shows that the first load-receiving means 16 is located in its maximum raised position, which is a retracted position in relation to the length of the container 2, above the upper tensioning element 18c between the two left vertical supports 18l so that the crane trolley 13 with the load-receiving means 16 and its spreader frame 16b and without a container 2 conveyed thereby can travel over the upper tensioning element 18c.

Furthermore, Figure 4 shows that the first cable 27 running from the first cable drum 25a upwards and horizontally in the direction of the first mast 14 is guided in the direction of a deflecting roller 29 mounted on the opposite side of the base frame 13a and is deflected vertically downwards through 90° by this deflecting roller out of its horizontal orientation. In a corresponding manner the other first cables 27 and the second cables 28 are deflected so that a total of four deflecting rollers 29 are disposed on the base frame 13a.

In a conventional manner the first spreader frame 16b and the second spreader frame 17b are respectively suspended via first chains 16c and second chains 17c on the first suspension frame 16a and the second suspension frame 17b.

Figure 5 illustrates a front view of Figure 3 with a further neighbouring bridge or gantry crane 9'. In this view the container store area 4c is clearly shown with containers 2 stacked on top of one another. In each case five containers are stacked one on top of another in the container store area 4c and are set down next to each other when seen in the trolley travel direction K and spaced about 40cm apart from each other. In a corresponding manner the first mast 14 and the second mast 15 are spaced apart from each other on the crane trolley 13 in the trolley travel

direction K in such a way that the first load-receiving means 16 and the second load-receiving means 17, in particular the first spreader frame 16b thereof and the second spreader frame 16c thereof, are spaced apart from each other when seen in the trolley travel direction K in such a way that containers 2 can be picked up from the container store area 4c or set down therein by the first load-receiving means 16 and the second load-receiving means 17 in a synchronous or time-offset manner but at least partially simultaneously.

In relation to the first and last row of containers 2, as seen in the trolley travel direction K, provision is made for these containers to be reached by the first load-receiving means 16 and also the second load-receiving means 17 so that each container 2 can be set down by the first load-receiving means 16 or the second load-receiving means 17 at each location of the container store area 4c or can be picked up therefrom. For this purpose the first carrier 12a and the second carrier 12b have been extended laterally over the left vertical support 18l and the right vertical support 18r to such an extent that, when seen in relation to the right vertical support 18r, a raised second load-receiving means 17 can extend laterally out of the container store area 4d so that the first load-receiving means 16 can pick up or set down a container 2 even in the last row of containers, and the first load-receiving means 16 in the first row. A corresponding situation is shown in Figure 5 in the case of the left-hand trolley 13.

It would also be feasible to lengthen the first carrier 12a and the second carrier 12b with the associated rails 20 only on the left-hand side, on which the housing 30 is disposed laterally next to the left-hand vertical support 18l. Corresponding lengthening on this side would not lead to an increase in the construction size of the bridge or gantry crane 9. If such lengthening is carried out on the right-hand side in relation to the right-hand vertical support 18r and corresponding lengthening also on a further parallel-disposed bridge or gantry crane 9', then between these vertical supports 18r, 18l' a region is produced which cannot be used for storing containers 2, but rather as a travel path 31, for example.

Figure 6 shows a front view of Figure 3 with a bridge or gantry crane 9 with the crane carrier 12 being of an alternative length. As already stated, it is also possible to allow the first carrier 12a and the second carrier 12b to end in the region of the lateral left-hand vertical support 18l and

right-hand vertical support 18r. This means that the first and last rows of stacked containers 2, as seen in the trolley travel direction K, in the store area 4c can be served only by the first mast 14, which is at the front as seen in the trolley travel direction K, with the first load-receiving means 16 in relation to the first row of containers 2, and in relation to the last row of containers 2 only with the second mast 15, which is at the rear as seen in the trolley travel direction K, with the second load-receiving means 16.

Figure 7 shows an enlarged section of Figure 1 from the region of a loading and unloading area 6 of a container store 4 of the handling installation 1 according to Figure 1. From this figure it is clear that in the area 10 in which containers are placed into and removed from storage a plurality of parking spaces 7 for automated guided vehicles 33 are disposed next to each other and with the smallest possible spacing from each other. The storage area 4c thus has nine rows of containers 2 set down next to each other, wherein four parking spaces 7 are provided therein for containers set down or picked up by automated guided vehicles 33. The parking spaces 7 for the containers 2 consist essentially of stationary support frames 7a onto which the containers 2 can be set down or picked up by the bridge or gantry crane 9 or the automated guided vehicle 33. For this purpose the support frames 7a are provided with set-down surfaces protruding laterally inwards as seen in the direction in which the automated guided vehicles 33 travel in and out, onto which set-down surfaces a container 2 raised by the automated guided vehicle 33 can be set down or picked up thereby.

Furthermore, Figure 8 shows a cross-sectional view of a bridge or gantry crane 9 according to Figure 5 from the region of the crane trolley 13. From this side view it is particularly clear that the first mast 14 and the second mast 15 are respectively guided via lower guide elements 32a in the region of the base frame 13a of the crane trolley 13 and via upper guide elements 32b in the region of the upper frame 23a of the carrier structure 23. The lower and upper guide elements 32a and 32b are formed as guide rollers which guide the first mast 14 and the second mast 15 from four sides in each case and in an opposite manner.

The description relates to a bridge or gantry crane 9, 9' which is formed as a gantry crane. It is fundamentally also possible to form the bridge or gantry crane 9, 9' as a bridge crane with raised

or elevated rails 11.

Reference list

	1	handling installation
	2	container
5	3	land-side handling area
	4	container store
	4a	land-side end
	4b	water-side end
	4c	container store area
10	4d	set-down area
	5	water-side handling area
	6	loading and unloading area
	7	parking space
	7a	support frame
15	8	lorry
	9, 9'	bridge or gantry crane
	10	area where containers are placed into or removed from storage
	11	rails
	12	crane carrier
20	12a	first carrier
	12b	second carrier
	12c	peak
	13	crane trolley
	13a	base frame
25	14	first mast
	14a	lower end of the first mast
	15	second mast
	15a	lower end of the second mast
	16	first load-receiving means
30	16a	first suspension frame
	16b	first spreader frame

	16c	first chain
	17	second load-receiving means
	17a	second suspension frame
	17b	second spreader frame
5	17c	second chain
	18a	base carrier
	18b	main tensioning element
	18c	upper tensioning element
	18l, 18l'	left-hand vertical support
10	18r	right-hand vertical support
	19	crane running gears
	20	trolley rail
	21	trolley running gears
	22	lower openings
15	23	support structure
	23a	upper frame
	23b	legs
	24	upper openings
	25	first hoisting mechanism
20	25a	first cable drum
	25b	second cable drum
	25c	first transmission
	25d	first drive motor
	26	second hoisting mechanism
25	26a	first cable drum
	26b	second cable drum
	26c	second transmission
	26d	second drive motor
	27	first cables
30	28	second cables
	29	deflecting roller

	30	housing
	31	travel path
	32a	lower guide elements
	32b	upper guide elements
5	33	automated guided vehicle
	F	crane travel direction
	H	raising and lowering direction
	K	trolley travel direction

Claims

- 1 Bridge or gantry crane, in particular for handling ISO containers, having a crane trolley
which can be moved along a crane carrier in the trolley travel direction and which
5 supports at least one mast which can be moved in a vertical raising and lowering direction
and on which a load-receiving means for containers is suspended, characterised in that the
crane trolley (13) supports a first mast (14) with a first load-receiving means (16) and
supports at least one second mast (15) with a second load-receiving means (17), and the at
least one second mast (15) is disposed behind and spaced apart from the first mast (14)
10 when seen in the trolley travel direction (K).
- 2 Bridge or gantry crane as claimed in claim 1, characterised in that the first mast (14) and
the at least one second mast (15) are spaced apart from each other in such a way that
respective containers (2) can be handled independently of each other in relation to the
15 movement in the raising and lowering direction (H) by the first load-receiving means (16)
disposed on the first mast (14) and by the second load-receiving means (17) disposed on
the at least one second mast (15).
- 3 Bridge or gantry crane as claimed in claim 1 or 2, characterised in that the first mast (14)
20 can be raised and lowered via a first hoisting mechanism (25) and the at least [one] second
mast (15) can be raised and lowered by a second hoisting mechanism (25).
- 4 Bridge or gantry crane as claimed in any one of claims 1 to 3, characterised in that the first
mast (14) and the second mast (15) are guided via first upper and lower guide elements
25 and via second upper and lower guide elements respectively on the crane trolley (13).
- 5 Bridge or gantry crane as claimed in any one of claims 1 to 4, characterised in that the
crane carrier (12) consists of a first carrier (12a) and a second carrier (12b), on which
trolley rails (20) are disposed on which the crane trolley (13) is able to travel in the trolley
30 travel direction (K), and the first carrier (12a) and the second carrier (12b) are spaced
apart from each other in the crane travel direction (F) which is at right angles to the trolley

travel direction (K).

- 6 Bridge or gantry crane as claimed in any one of claims 1 to 5, characterised in that a first mast (14) and a second mast (15) are disposed on the crane trolley (13).

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- 7 Bridge or gantry crane as claimed in any one of claims 1 to 6, characterised in that the first mast (14) and the second mast (15) are each formed of one piece and are rigid.