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A Cargo Container Trailer

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This invention relates to cargo container trailers and, more particularly, to cargo container trailers on which cargo containers may be vertically stacked.

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Cargo container trailers are used to transport cargo containers to and fro between the quay side and the stacking yards in a port. Conventionally cargo container trailers are loaded by quayside or yard cranes with either a single 40' ISO cargo container, a single 45' ISO cargo container or two 20' ISO cargo containers per trip. The cargo containers are mounted on conventional trailers in a single tier and the maximum payload of these trailers is between 40 and 50 tonnes.

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Two-tier low-bed open cargo container trailers are in use in some ports. The first or bottom tier of cargo containers is placed on a trailer. The second or top tier is placed on the first tier and the second tier is then manually secured to the first tier. The securing step is normally carried out by placing a bridging cone at each of the adjacent corners of the top and bottom containers. The bridging cone is similar to a twist lock and is used to secure cargo containers together by engaging lugs on the twist lock with apertures in the corners of the cargo containers as shown in Figs. 1a and 1b of the accompanying drawings. Similarly, the bottom container(s) are secured to the trailer by a set of twist locks located adjacent each of the corners on the bottom surface of the cargo container. The twist locks for the bottom container(s) are formed as an integral part of the trailer.

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The task of locking the twist locks and bridging cones must be undertaken manually, thus requiring supervision and increasing the probability of some human error.

5 It is therefore an object of the present invention to provide a cargo container trailer which can be loaded with cargo containers automatically without having to manually secure the cargo containers to one another and the trailer.

10 Accordingly, in one aspect of the present invention, a cargo container trailer is provided for vertically stacking one or more cargo containers on top of one another, the trailer comprising a base having a substantially rectangular periphery of a pre-determined
15 length and width, the periphery being provided with a plurality of upstanding guide members positioned on the base to locate each container on the base or on the container below, in which trailer at least two of the upstanding guide members are disposed adjacent one another
20 at a corner of the periphery, one upstanding guide member on each of the adjacent sides of the periphery defining the corner.

One embodiment of the present invention provides a cargo container trailer for vertically stacking a plurality
25 of cargo containers one on top of another, the trailer comprising a base on which a plurality of upstanding guide members are located, the upstanding guide members being positioned on the periphery of the trailer base to securely locate the containers on the trailer, in which trailer at
30 least one restraining member is located at a position between two horizontally adjacent containers such that the horizontally adjacent containers cannot move into close proximity with one another.

Another embodiment of the present invention provides a speed warning device comprising a first sensor indicating the speed of a vehicle and a second sensor indicating the radius of the turn being executed by the vehicle, the speed warning device activating a warning signal when the vehicle exceeds a given speed whilst executing a turn of pre-determined radius.

In order that the present invention may be more readily understood, embodiments thereof will now be described, by way of example, with reference to the accompanying drawing, in which:

Figs. 1a and 1b illustrate a conventional single tier cargo container trailer and a known double tier cargo container trailer, the containers are secured to one another and the trailer by means of twist-locks and bridging cones which are shown in detail;

Fig. 2 illustrates a side view of a partially loaded cargo container trailer according to one embodiment of the present invention, the spreaders of both the yard and the quay cranes are also illustrated;

Fig. 3 is a perspective view of a restraining device according to one embodiment of the present invention;

Figs. 4a and 4b illustrate one particular type of plunger which can be used with the restraining device of Fig. 3;

Fig. 4c illustrates a plane bearing for use with the plunger of Figs. 4a and 4b;

Fig. 5a is a diagrammatic illustration of the various components which comprise a speed warning device in accordance with one embodiment of the present invention;

Fig. 5b is a cross section through the base of a trailer carrying two limit switches for use with the speed warning device of Fig. 5a;

5 Figs. 6a and 6b illustrate a cargo container trailer fitted with self-steering apparatus in accordance with one embodiment of the present invention;

10 Figs. 7a, 7b, 7c, 7d, 7e and 7f illustrate a cargo container trailer embodying one aspect of the present invention loaded with various configurations of cargo containers; and

15 Fig. 8 illustrates a cargo container trailer embodying yet another aspect of the present invention.

Referring to Fig. 2, a cargo container trailer having a front end 2 and a rear end 3 includes a chassis 4 which acts as a base for the trailer 1 and a number of
20 wheels 5 which are located towards the rear end 3 of the trailer and which are attached to the trailer chassis 4 by way of a number of axles 6. When the trailer is not being towed by the truck 7, the front end 2 of the trailer 1 is supported by two stands 8 which project downwardly from the
25 front end 2 and which maintain the trailer 1 in a level position. The trailer is coupled to the truck 7 by means of a king-pin 10 which extends downwardly from a goose-neck formed at the front end 2 of the trailer 1. The king-pin 10 of the trailer is securely received in a conventional
30 fifth wheel of the truck 7.

The trailer chassis 4 is constructed from two elongate beams 11 of I-shaped cross section which are disposed parallel to one another and are linked by a
35 plurality of cross members 12. Some of the cross-members 12 project from the outer surfaces of the I-beams 11 and provide a mounting position for a number of vertical members 14 as seen in Fig. 3.

The vertical members 14 are guide members which are formed as columns around the periphery of the trailer 1. The dimensions of the trailer 1 periphery are dictated by the size of the standard ISO containers 15.

Each vertical guide column 14 has a height which is slightly greater than the height of a standard ISO container 15 resting on the trailer chassis 4. The vertical guide columns 14 are mounted, as previously described, on the projecting cross-members 12 and each vertical guide column 14 has an inwardly facing surface defining a contact face 16. The top portion 17 of each contact face 16 is chamfered to allow for any slight misalignment of a descending cargo container 15.

The vertical guide columns 14 are linked by two layers of horizontal cross-members 18, 19 which strengthen the structure. See Fig. 2. The first layer of horizontal cross members 18 are each attached to the mid points of all of the vertical guide columns 14 on the two faces adjacent the contact face 16. The second layer of horizontal members 19 are only attached between alternate pairs of vertical guide columns 14 near the top portion 17 of the vertical guide columns 14. In this particular embodiment the front and rear ends 2, 3 of the trailer 1 are each bounded by a pair of vertical guide columns and two pairs of vertical guide columns 14 are provided on each lengthwise side of the trailer 1. The resulting structure creates a hollow cage with an open top.

Each cross member 19 in the second layer is supported by a pair of corner supports 20, each of which attaches to one of the pairs of vertical guide columns 14. The first and second layers of horizontal braces 18, 19 and the corner supports 20 are made from circular cross-section piping.

Bearings 21 in the form of sections of circular cross-section piping which enclose the circular piping of the first layer braces 18 are provided. The bearings alleviate the wear on the horizontal braces 18 caused by contact with a descending container 15 and are positioned at key locations, such as at the front and rear ends 2, 3 of the trailer 1 and at the mid-point of the trailer 1.

The vertical guide columns 14 positioned on the front and rear ends 2, 3 of the trailer are reinforced by buttresses 22 which are secured to the chassis 4. The top of each buttress 22 is secured to the front and rear end pairs of vertical guide columns 14 by means of the two horizontal braces 18, 19 joining each pair of front and rear end vertical guide columns 14.

The vertical guide columns 14 are positioned around the periphery of the trailer 1 to act as guides which will direct the containers 15 into alignment with the trailer base 4. The trailer base includes two stopper pins 23 (See Fig. 3) which project upwardly from the trailer base 4 and are positioned in the middle of the trailer base 4 so that the pins 23 protrude between two 20' ISO containers 15 carried on the trailer base 4. The stopper pins 23 can be spring loaded so that they will retract when, for example, a 40' ISO container 15 is placed on top of the pins 23.

A 40' ISO container 15 placed onto the trailer base 4 as the bottom container would be prevented from moving with respect to the trailer 1 by the vertical guide columns 14 which are positioned such that the respective contact faces 16 of the vertical guide columns 14 would be in contact with the side, front and rear upstanding sides of the container 15. A 20' ISO container placed at the front end 2 of the trailer would be prevented from moving

laterally with respect to the trailer 1 by the vertical guide columns 14 on the lengthwise sides of the trailer. The 20' ISO container would be prevented from moving forwards on the trailer 1 by the front end pair of vertical guide columns 14, and backwards on the trailer 1 by the two stopper pins 23 which would engage the bottom edge of the rear upstanding side of the container 15. Similarly, a 20' ISO container 15 placed at the rear end of the trailer 1 is prevented from moving by the side vertical guide columns 14, the rear end pair of vertical guide columns 14 and the two stopper pins 23.

Thus, any configuration, such as a 40' ISO container on the trailer base 4, a single 20' ISO container or two 20' ISO containers on the trailer base 4, would be secured by the vertical guide columns 14 and, in the case of the 20' ISO containers by the two stopper pins 23.

Having loaded the bottom layer of the trailer 1, the top may be loaded. If the bottom layer is full, i.e. two 20' ISO containers or one 40' ISO container, then either one 40' ISO container or a maximum of two 20' ISO containers may be loaded. If, on the other hand, the bottom layer only contains a single 20' ISO container, then only a single 20' ISO container may be stacked on the bottom layer.

Because the vertical guide columns 14 are taller than the height of the container(s) 15 on the trailer base 4, the top portions of all the vertical guide columns 14 still engage the lower portions of the container(s) on the top layer which are therefore prevented from moving. However, the vertical guide columns 14 only prevent the container(s) 15 from moving outside the trailer periphery and do not prevent movement within the trailer periphery.

Consequently, a single 20' ISO container located on a 40' ISO container could move along the length of the trailer if the trailer driver exceeded a maximum speed or drove erratically.

Hence, in a further embodiment of the invention, two restraining devices 24 (see Fig. 3) are provided to prevent the top shorter 20' ISO cargo containers 15 from sliding along the trailer 1 when stacked upon a 40' ISO container or upon two 20' ISO containers 15. Each of the restraining devices 24 is positioned at the mid-point of the trailer 1 which is, in one particular embodiment, 20' from both the front and rear ends 2, 3 of the trailer 1.

Each restraining device 24 consists of a vertical column 14 which is of substantially the same height as the vertical guide columns 14. The restraining device 24 has an inwardly facing surface 16 similar to the contact faces 16 of the vertical guide columns 14. The top portion 17 of the restraining device column 24 is also chamfered to compensate for any slight mis-alignment of a descending container 15. A recess 25 is formed at a predetermined height in the contact face 16 just below the chamfered portion 26. The recess 25 is dimensioned to receive a plunger 27 such that the plunger 27 can be completely disposed within the recess 25.

The plunger 27 (see Figs. 4 and 4b) comprises a hollow casing 28 of generally octagonal shape with a rectangular base 29. The octagonal portion has a main facia 30, upper and lower sloped sides 31a,b, two side faces 32a,b which extend orthogonally outwards from the recess 25 and which are substantially vertical and four triangular corner faces 33a,b,c,d. Different configurations for the shape of the plunger 27 are

possible, such as a substantially square box-like casing formed with upper and lower sloped sides.

5 The rectangular base 29 of the plunger 27 is provided with four springs 34 which are located in hollow portions of the base 29. The springs 34 urge the plunger 27 out of the recess 25 and can be compressed to allow the plunger 27 to be forced back into the recess 25.

10 The height at which the plunger 27 is located is critical. As shown in Fig. 2, the plunger 27 is located at a height determined by the bottom container(s) 15 such that the vertical side faces 32a,b of the plunger 27 are interposed only between the containers 15 on the top level.
15 ISO containers normally have a height in the range of 8' to 9.5' (2.4 to 2.9m).

 When the top container 15 is a 40' ISO cargo container, the side walls on both sides of the top container 15 will force the plunger 27 to retreat into the recess 25. The restraining devices 24 are not required for the top 40' container which is secured solely by the vertical column guides 14.

25 The plunger 27 is fabricated from steel plate and the protruding portion of the plunger 27 is welded to the rectangular base 29 which can slide in and out of the recess 25. Bronze plates 35 (as shown in Fig. 4c) are fitted to the inner surfaces of the recess 25 to act as
30 plane bearings to minimise the friction between the base 29 and the recess 25 thus reducing the plunger wear.

 The main function of the restraining device 24 is to act as a stopper to prevent the sliding of the top 20' containers 15 during any sudden acceleration or
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deceleration of the trailer 1. The restraining devices 24 will also prevent a single 20' ISO container stacked on top of a bottom layer from moving horizontally with respect to the lower container layer. The cargo container trailer 1 may therefore be safely stacked with two layers of cargo containers 15. None of the cargo containers in these layers need be manually secured to one another or to the trailer base 4 thus saving a considerable amount of time in the loading/unloading procedure and requiring less manpower.

As an alternative to using a pair of restraining devices 24, a pair of centre bearings 21 (shown in Figure 8) can be positioned at the midpoint of the trailer 1 instead. The centre bearings 21 allow the cargo containers 15 to be lowered onto the trailer base 4 whilst reducing the frictional contact with the first layer braces 18.

The design and arrangement of the vertical guide columns 14 around the periphery of the trailer is fully compatible with a stacking yard crane 36 shown in Fig. 2. The vertical guide columns 14 do not obstruct or interfere with fixed guides 37 which protrude from a spreader 36 of the crane during the loading and unloading of the containers 15 onto and off of the cargo container trailer 1. Similarly, the vertical guide columns 14 do not interfere with the operation of flippers 38 incorporated in the quayside crane spreader 39 during loading and unloading of the top containers 15.

Yard cranes are used to stack and unstack containers 15 at the container terminal yards. Each yard crane comprises a spreader 36 which is fitted with four fixed guides 37 which assist the crane operator to square

the spreader 36 onto the container 15 quickly and efficiently.

Quayside cranes are used to load and unload containers 15 directly from the ship to the cargo container trailers 1 and vice versa. The quayside crane comprises a spreader 39 which is fitted with four flippers 38 which the crane operator can either flip up or down independently or in combination with one another. When loading or unloading the bottom containers 15 onto the cargo container trailer 1 according to the present invention, the flippers 38 must be flipped up. However, when loading the top containers 15 onto a cargo container trailer 1 according to the present invention, the flippers 38 need not be flipped up as these do not interfere with the vertical guide columns 14 due to the low height of the vertical guide columns 14.

A speed warning device 100 (see Figs. 5a and 5b) may also be incorporated into the cargo container trailer 1 to alert the truck driver when a pre-determined travelling speed has been exceeded when executing turns, thus preventing the truck driver from toppling the trailer 1 over.

The speed warning device 100 receives two input signals comprising the trailer travelling speed and the trailer turning radius. When the values of the first and second signals both reach respective pre-determined thresholds, the driver is alerted.

The first signal indicates the trailer travelling speed and is provided by the speedometer sensor 101 of the transmission output drive shaft 102 as for the truck. An electrical pulse generator 103 is connected to the truck 7 speedometer sensor shaft. This generator 103 converts the

travelling speed of the trailer 1 into electrical pulses and sends this information continuously to the speed warning device 100.

5 The second signal is provided by a turning radius sensor 104 (shown in Fig. 5b) which determines the turning angle of the trailer 1. The turning angle of the trailer 1 is obtained by two limit switches 105a, b located on the
10 goose-necked portion of the trailer 1. One of the two limit switches 105a, b comes into contact with the fifth wheel 10 of the truck 7 when the angle between the trailer 1 and the truck 7 exceeds a certain limit, such as 30° or more, which is equivalent to a turning radius of about 10 metres. The use of proximity switches instead of limit
15 switches for this purpose has been envisaged. Additionally, the fifth wheel 10 may trigger both switches when the limit angle is exceeded.

20 When the travelling speed reaches a pre-determined threshold, such as 15 kilometres an hour and one of the limit switches 105a, b is activated, the speed warning device alarm will be triggered.

25 The speed warning device 100 indicates to the driver that the speed and turning radius threshold have been exceeded via an internal warning device such as a dashboard LED 106. This information can also be indicated externally via an external warning device such as a
30 flashing light 107 located, for example, on the driver's cabin roof.

35 The speed warning device 100 can also be adapted to indicate when the driver exceeds a straight line travelling speed.

In one embodiment the cargo container trailer 1 is fitted with two fixed 120 and two self steering axles 121 such as those shown in Figs. 6a and 6b. The self-steering axles 121 are rated at 20 to 25 tonnes at 25 kilometres an hour in this particular embodiment. The frictional forces between the road surface and the wheels 5 cause the wheels 5 to steer themselves thus aiding the turn. Additional self steering pneumatic devices 122 (see Fig. 6b) may be provided to improve self-steering during heavy pay-load applications.

Figs. 7a, 7b, 7c, 7d, 7e and 7f show some of the various container combinations which are possible when using a cargo container trailer 1 according to one embodiment of the present invention. The cargo container trailer 1 is designed to accommodate the stacking of containers 15 regardless of the container load distribution. Thus, both empty and loaded containers may be stacked together.

A method of loading the cargo containers 15 onto a trailer 1 comprises the steps of: locating a quayside or yard crane 36, 39 carrying a container 15 above the cargo container trailer 1, aligning the container 15 with the trailer 1, lowering the container 15 such that the upstanding container surfaces engage the vertical guide columns 14, lowering the container 15 onto the base 4 of the trailer 1 thus creating a first container layer, then, when the bottom layer of the trailer 1 has been filled by either one or two containers 15, lowering one or two containers 15 onto the bottom container(s), again locating the upstanding container surfaces with the vertical guide columns 14. No manual locking of the containers 15 to one another or to the trailer base 4 is necessary.

**CLAIMS: -**

1. A cargo container trailer for vertically stacking one or more cargo containers on top of one another, the trailer comprising a base having a substantially rectangular periphery of a pre-determined length and width, the periphery being provided with a plurality of upstanding guide members positioned on the base to locate each container on the base or on the container below, in which trailer at least two of the upstanding guide members are disposed adjacent one another at a corner of the periphery, one upstanding guide member on each side of the adjacent sides of the periphery defining the corner.

2. A cargo container trailer according to Claim 1, wherein pairs of the upstanding guide members are provided on all four corners of the trailer base periphery with one upstanding guide member of each pair on each of the adjacent sides of the periphery defining each corner.

3. A cargo container trailer according to any preceding claim, wherein the upstanding guide members are columns.

4. A cargo container trailer according to any preceding claim, wherein each upstanding guide member is formed with a chamfered top portion.

5. A cargo container trailer according to Claim 4, wherein the chamfered top portion of each upstanding guide member faces towards the inside of the trailer base periphery.

6. A cargo container trailer according to any preceding claim, wherein the upstanding guide members support



horizontal elongate members which are provided with one or more bearings to further locate containers on the base.

7. A cargo container trailer according to any preceding claim, wherein at least one restraining member comprising a plunger formed in a recess in an upstanding guide member is located at a position between two horizontally adjacent containers such that the horizontally adjacent containers cannot move into close proximity with one another.

8. A cargo container trailer according to Claim 7, wherein the horizontally adjacent containers are stacked on top of a bottom container layer, the plunger being located between the containers stacked on top of the bottom container layer.

9. A cargo container trailer according to Claim 7 or 8, wherein the plunger is urged out of the recess by resilient means.

10. A cargo container trailer according to Claim 9, wherein the resilient means comprises a plurality of springs located inside a hollow portion of the plunger.

11. A cargo container trailer according to any preceding claim, wherein two restraining members are provided opposite one another on the periphery of the trailer base.

12. A cargo container trailer according to any preceding claim, wherein the trailer base is provided with a number of axles for the attachment of wheels, there being two fixed axles and three self-steering axles.



13. A cargo container trailer according to any one of Claims 1 to 11, wherein the trailer base is provided with a number of axles for the attachment of wheels, there being two fixed axles and two self-steering axles.

14. A cargo container trailer according to any preceding claim further including a speed warning device comprising a first sensor indicating the speed of the trailer and a second sensor indicating the radius of the turn being executed by the trailer, the speed warning device activating a warning signal when the trailer exceeds a given speed whilst executing a turn of pre-determined radius.

15. A cargo container trailer according to Claim 14, wherein the first sensor is an electrical pulse generator monitoring the speed of the main drive shaft of a truck pulling the trailer.

16. A cargo container trailer according to Claim 15, wherein the second sensor is mounted on the underside surface of the trailer and is operable by a fifth wheel of a truck.

17. A cargo container trailer according to any one of Claims 14 to 16, wherein the second sensor comprises two micro switches.

18. A cargo container trailer substantially as hereinbefore described with reference to and as shown in Figures 2 to 8.