

APPARATUS FOR SUPPORTING A LOAD ON A TRUCK OR A TRAILER AND METHOD OF OFF-LOADING THE LOAD

Cross-reference to Related Applications

5 [0001] The present application claims the priority of Singapore patent application no. 10201509084W filed on 4 November 2015 and Singapore patent application no. 10201602197V filed on 21 March 2016, the entire contents of which are incorporated herein by reference for all purposes.

10 Technical Field

[0002] Embodiments relate generally to an apparatus for supporting a load on a truck or a trailer, and a method of off-loading the load from the truck or the trailer.

Background

15 [0003] The turn-around time associated with the loading and unloading of medium-to-heavy goods vehicles (HGVs) such as walled semis or flat-bed trailers or loaded truck chassis and cabs is one of the largest costs associated with the transport industry as it is inefficient to have a HGV operator idle for long periods and ways and means to cut down this turnaround time are always being sought by the industry. For example, a loading and unloading evolution in the Takkyubin (Japanese National Delivery Service provided by such companies as Kuroneko
20 Yamato and Sagawa Kyubin) service can take approximately two hours (or more) per 9.2 metre (Giga type) HGV Body.

[0004] Detachable/demountable truck bodies system or swap body system, which allow goods to be loaded or unloaded independent of the truck or the tractor unit, has been known in
25 the transport industry. The detachable/demountable truck bodies of such system typically include an outrigger landing gear. For example, as disclosed in US4522550, the detachable platform includes an outrigger landing gear having a leg with horizontal side extension portion such that the operator may manually extend the legs sideways and manually pivot the legs downward to deploy the outrigger landing gear. With the outrigger landing gear deployed, the
30 detachable platform may stand in place while the truck (cab and chassis) or the tractor unit may drive off. Such manual system may take a longer time to deploy and may be difficult for a single person to operate. Further, as the leg of the outrigger landing gear is typically made of metal and can be rather heavy, manual deployment of the leg may pose a danger or cause injury to the operator.

35 [0005] Over the years, variants of outrigger landing gear have been developed. These outrigger landing gears typically require either an electrical hook-up to power lifting motors or

hydraulic pumps to deploy and or lift the truck bed. However, these are expensive and typically do not have manual operations in the event of equipment failure. More recently, WO2007/049067 disclosed a vertically telescopic landing leg that is actuated pneumatically. The locking of the landing leg is also pneumatically actuated. The pneumatically actuated landing leg may be easier to deploy as compared to the manual deployment, however, such vertical telescopic landing leg compromises on the stabilizing effect of the side extension of the outrigger landing gear. Further, mere pneumatic actuated locking of the leg may not be sufficiently safe when the pneumatic actuation is turned off during transportation. This is because vibration of the landing legs due to the road conditions during transportation may cause the locking mechanism to accidentally dislodge resulting in the deployment of the leg, thus causing damage to the leg.

[0006] Accordingly, example embodiments seek to provide an apparatus for supporting a load on a truck or a trailer, and a method of off-loading the load from the truck or the trailer that addresses at least some of the issues identified above.

Summary

[0007] According to various embodiments, there is provided an apparatus for supporting a load and for detachably mounting to a truck or a trailer. The apparatus may include a frame configured to support the load and configured to be detachably mounted to the truck or the trailer; and an outrigger assembly mounted to the frame. The outrigger assembly may include a bracket mounted to the frame, a shaft movably received in the bracket and a leg member coupled to an end of the shaft. The bracket may include a first cooperative element. The shaft may include a second cooperative element. The leg member may be at least substantially perpendicular to the shaft. The first cooperative element of the bracket and the second cooperative element of the shaft may be engaged with each other and may be configured to be operable to rotate the shaft relative to the bracket about a longitudinal axis of the shaft.

[0008] According to various embodiments, there is provided a method of off-loading a load from a truck or a trailer with the load supported by the apparatus as described herein and with the apparatus mounted to the truck or the trailer. The method may include raising the truck or the trailer, using a height adjustment mechanism of the truck or the trailer, to raise the frame of the apparatus. The method may further include deploying the leg member of the outrigger assembly of the apparatus. The method may also include lowering the truck or the trailer, using the height adjustment mechanism of the truck or the trailer, to lower the frame of the apparatus for the leg member to contact a ground. The method may include lowering the truck or the trailer, using the height adjustment mechanism of the truck or the trailer, to detach the apparatus from the truck or the trailer.

Brief description of the drawings

[0009] In the drawings, like reference characters generally refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead
5 generally being placed upon illustrating the principles of the invention. In the following description, various embodiments are described with reference to the following drawings, in which:

FIG. 1A shows a schematic diagram of an apparatus for supporting a load and for detachably mounting to a truck or a trailer according to various embodiments;

10 FIG. 1B shows a schematic diagram of an apparatus for supporting a load and for detachably mounting to a truck or a trailer according to various embodiments;

FIG. 2 illustrates a method of off-loading a load from a truck or a trailer with the load supported by the apparatus of FIGs. 1A or 1B according to various embodiments;

15 FIG. 3 shows a detachable/demountable truck bodies system utilising an apparatus for supporting a load and for detachably mounting to a truck or a trailer according to various embodiments;

FIGs. 4A, 4B and 4C show a perspective view, a top view and a side view of an apparatus for supporting a load and for detachably mounting to a truck or a trailer according to various embodiments;

20 FIG. 5 shows a truck with a bare chassis according to various embodiments;

FIGs. 6A and 6B illustrate the deployment of the outrigger assembly of the apparatus of FIGs. 4A, 4B and 4C when mounted to the truck of FIG. 5 according to various embodiments;

FIGs. 7A and 7B show an apparatus for supporting a load and for detachably mounting to a truck or a trailer according to various embodiments;

25 FIGs. 8A and 8B illustrate the deployment of the outrigger assembly of the apparatus of FIGs. 7A and 7B when mounted to the truck of FIG. 5 according to various embodiments;

FIG. 9 shows a method of off-loading a load from a truck according to various embodiments;

30 FIG. 10 shows an apparatus for supporting a load and for detachably mounting to a vehicle according to various embodiments;

FIG. 11A shows an assembled view and an exploded view of the outrigger arm of FIG. 10 in a completely retracted and stowed position according to various embodiments;

FIG. 11B shows a perspective view of the outrigger arm of FIG. 10 in a fully deployed and extended position according to various embodiments;

35 FIG. 12 shows a side view and a perspective view of a shaft of the outrigger arm of FIG. 10 according to various embodiments;

FIG. 13 shows a guide key bolt of the outrigger arm of FIG. 10, a front view of a collar of the outrigger arm of FIG. 10, a side view of the collar of the outrigger arm of FIG. 10 and a perspective view of the collar of the outrigger arm of FIG. 10 according to various embodiments;

5 FIG. 14A shows a main control box and a sub control box of the outrigger arm of FIG. 10 according to various embodiments;

FIGs. 14B to 14F illustrate the deployment of the outrigger arm of FIG. 10 according to various embodiments;

10 FIGs. 15A to 15E illustrate the deployment of the apparatus of FIG. 10 according to various embodiments;

FIG. 16A shows the apparatus of FIG. 10 in a fully stowed and retracted position according to various embodiments;

FIGs. 16B and FIG. 16C show the apparatus of FIG. 10 in a 4-leg configuration and a 6-leg configuration respectively according to various embodiments;

15 FIG. 16D show the leg member of the outrigger arm of FIG. 10 in a deployed vertical position and a retracted horizontal position according to various embodiments;

FIG. 17A shows an outrigger arm in a completely retracted and stowed position according to various embodiments;

20 FIG. 17B shows the outrigger arm of FIG. 17A in a partial deployed position according to various embodiments;

FIG. 17C shows the outrigger arm of FIG. 17A in a fully deployed and extended position according to various embodiments;

FIG. 17D shows a bracket of the outrigger arm of FIG. 17A according to various embodiments;

25 FIG. 17E shows an assembled view of a rotator actuator and a rotator of the outrigger arm of FIG. 17A according to various embodiments;

FIG. 17F shows a shaft actuator and a shaft of the outrigger arm of FIG. 17A according to various embodiments;

30 FIGs. 18A and 18B show an apparatus for supporting a load and for detachably mounting to a vehicle according to various embodiments;

FIG. 19 shows a front view, a side view and a plan view of the locking pin of the apparatus of FIGs. 18A and 18B according to various embodiments;

FIG. 20 shows a perspective view of the arm and the leg of the apparatus of FIGs. 18A and 18B according to various embodiments;

35 FIG. 21 shows a front view, a side view and a plan view of the locking pin of the apparatus of FIGs. 18A and 18B according to various embodiments;

FIGs. 22A and 22B show a front view and a side view of the arm and the leg of the apparatus of FIGs. 18A and 18B according to various embodiments;

FIG. 23 shows a front view and a side view of an outer housing sleeve of the arm of the apparatus of FIGs. 18A and 18B according to various embodiments;

5 FIG. 24 shows a front view 2401 and a side view 2403 of an inner telescoping outrigger sleeve of the arm of the apparatus of FIGs. 18A and 18B according to various embodiments;

FIG. 25 shows a front view and a side view of an outer housing sleeve of the leg of the apparatus of FIGs. 18A and 18B according to various embodiments;

10 FIG. 26 shows a front view and a side view of an inner telescoping landing sleeve leg of the apparatus of FIGs. 18A and 18B according to various embodiments;

FIGs. 27A to 27I illustrate the deployment of the apparatus of FIGs. 18A and 18B according to various embodiments;

FIG. 28 shows a front view and a plan view of a control box of the apparatus of FIGs. 18A and 18B according to various embodiments;

15 FIGs. 29A to 29D show the operation of the locking mechanism of the apparatus of FIGs. 18A and 18B according to various embodiments;

FIG. 30A shows an exploded view of a locking mechanism an outrigger assembly according to the various embodiments;

20 FIG. 30B shows an assembled view of the locking mechanism of FIG. 30A according to various embodiments;

FIGs. 30C and 30D illustrates the operation of the locking mechanism of FIG. 30B according to various embodiments; and

FIG. 31 shows the locking mechanism of FIG. 30B used in a vertically extendible outrigger assembly according to various embodiments.

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Detailed description

[0010] Embodiments described below in context of the apparatus are analogously valid for the respective methods, and vice versa. Furthermore, it will be understood that the embodiments described below may be combined, for example, a part of one embodiment may be combined
30 with a part of another embodiment.

[0011] It should be understood that the terms “on”, “over”, “top”, “bottom”, “down”, “side”, “back”, “left”, “right”, “front”, “lateral”, “side”, “up”, “down” etc., when used in the following description are used for convenience and to aid understanding of relative positions or directions, and not intended to limit the orientation of any device, or structure or any part of any
35 device or structure. In addition, the singular terms “a”, “an”, and “the” include plural referents

unless context clearly indicates otherwise. Similarly, the word “or” is intended to include “and” unless the context clearly indicates otherwise.

[0012] For the avoidance of doubt, in this specification the term ‘heavy goods vehicle’ or ‘HGV’ includes those of the type known generally as an ‘empty truck chassis and cab’, ‘cab chassis’ or ‘chassis cab’.

[0013] Furthermore, the term ‘load’ refers to any goods containing transport container or cargo pod, detachable HGV body, flat bed, curtain sided container, tank, ISO container, ISO tank, cargo with ISO frames etc.

[0014] FIG. 1A shows a schematic diagram of an apparatus 100 for supporting a load and for detachably mounting to a truck or a trailer. The apparatus 100 may include a frame 110 configured to support the load and configured to be detachably mounted to the truck or the trailer. The load supported by the apparatus 100 may be any types of load, for example any goods containing transport container or cargo pod, detachable HGV body, flat bed, curtain sided container, tank, ISO container, ISO tank, cargo with ISO frames etc. Accordingly, the frame 110 of the apparatus 100 may be configurable such that different configuration of the load may be attached to the frame 110. The frame 110 of the apparatus 100 may also be configurable such that the apparatus 100 may be detached from the truck or the trailer to separate the load from the truck or the trailer so as to allow the truck or the trailer to be used for transporting other load while the load remains on the apparatus 100 as the apparatus 100 stands on its own legs. The frame 110 of the apparatus 100 may also be configured such that the apparatus 100 may be modular and suitable for mounting on different truck chassis or trailer. The interchangeability between different configurations of the load and the modularity of the apparatus 100 to mount on different truck or trailer may enhance the versatility of the apparatus 100, making the apparatus 100 suitable for multi-purpose use.

[0015] The apparatus 100 may further include an outrigger assembly 140 mounted to the frame 110. According to various embodiments, the apparatus 100 may include at least one outrigger assembly 140, or a pair of outrigger assembly 140, or multiple pairs of outrigger assembly 140. The outrigger assembly 140 may include a bracket 142 mounted to the frame 110. The bracket 142 may include a first cooperative element 144. The outrigger assembly 140 may include a shaft 146 movably received in the bracket 142. The shaft 146 may include a second cooperative element 148. Accordingly, the bracket 142 may be in the form of a sleeve, a tube, a substantially U-shaped mounting, a hollow mounting or the like that may be able to receive the shaft 146 to hold, support or bear the shaft 146 with respect to the frame 110. The shaft 146 may be movable with respect to the bracket 142 such that the shaft 146 may be slidable or translatable along a longitudinal axis of the shaft 146 and rotatable about the longitudinal axis of the shaft 146 with respect to the bracket 142. Further, the outrigger

assembly 140 may include a leg member 150 coupled to an end of the shaft 146 and the leg member 150 may be at least substantially perpendicular to the shaft 146.

[0016] According to various embodiments, the first cooperative element 144 of the bracket 142 and the second cooperative element 148 of the shaft 146 may be engaged with each other and may be configured to be operable to rotate the shaft 146 about the longitudinal axis of the shaft 146. Accordingly, the first cooperative element 144 of the bracket 142 and the second cooperative element 148 of the shaft 146 may be adapted to work together such that the manner in which the first cooperative element 114 interacts with the second cooperative element 148 may cause the shaft 146 to rotate relative to the bracket 142. Thus, the engagement between the first cooperative element 114 and the second cooperative element 148 may mechanically and actively rotate the shaft 146 relative to the bracket 142. Advantageously, in this configuration, automatic mechanical control for the rotation of the shaft 146 with respect to the bracket 144 may be achieved.

[0017] In other words, the apparatus 100 for supporting a load and for detachably mounting to a truck or a trailer may include a mainbody capable of supporting the load and also capable of being detached and mounted to the truck or the trailer. The apparatus 100 may also include a stabilizing structure that may be extendable from the mainbody to enhance stability or provide support to the mainbody. The stabilizing structure may include a 'L' shape component and a joint connecting the 'L' shape component to the mainbody. The connection between the 'L' shape component and the joint may be such that a first arm of the 'L' shape component may be inserted into the joint. The first arm of the 'L' shape component may be movable relative to the joint, i.e. the first arm of the 'L' shape component may be slidable or translatable along a longitudinal axis of the first arm of the 'L' shape component and may be rotatable about the longitudinal axis of the first arm of the 'L' shape component. The first arm of the 'L' shape component may include a first coacting member and the joint may include a second coacting member. The first coacting member and the second coacting member may interact with each other such that as the first arm of the 'L' shape component may be controlled to rotate about the longitudinal axis of the first arm due to the interaction between the first coacting member and the second coacting member to cause the second arm of the 'L' shape component, which is at least substantially perpendicular to the first arm, to pivot about the longitudinal axis of the first arm of the 'L' shape component.

[0018] FIG. 1B shows a schematic diagram of an apparatus 101 for supporting a load and for detachably mounting to a truck or a trailer. The apparatus 101 may, similar to the apparatus 100 of FIG. 1A, include a frame 110 configured to support the load and configured to be detachably mounted to the truck or the trailer. The apparatus 101 may, similar to the apparatus 100 of FIG. 1A, further include an outrigger assembly 140 mounted to the frame 110. The

outrigger assembly 140 may include a bracket 142 mounted to the frame 110. The bracket 142 may include a first cooperative element 144. The outrigger assembly 140 may include a shaft 146 movably received in the bracket 142. The shaft 146 may include a second cooperative element 148. The outrigger assembly 140 may further include a leg member 150 coupled to an end of the shaft 146 and the leg member 150 may be at least substantially perpendicular to the shaft 146. According to various embodiments, the first cooperative element 144 of the bracket 142 and the second cooperative element 148 of the shaft 146 may be engaged with each other and may be configured to be operable to rotate the shaft 146 about the longitudinal axis of the shaft 146.

[0019] According to various embodiments, the first cooperative element 144 of the bracket 142 and the second cooperative element 148 of the shaft 146 may be engaged with each other and may be configured to be operable to rotate the shaft 146 about the longitudinal axis of the shaft 146 as the shaft 246 translates along the longitudinal axis of the shaft 246. Accordingly, the first cooperative element 144 of the bracket 142 and the second cooperative element 148 of the shaft 146 may be adapted to work together such that a force applied solely to move, slide or translate the shaft 146 relative to the bracket 142 longitudinally along the longitudinal axis of the shaft 146 may cause the shaft 146 to simultaneously rotate relative to the bracket 142 without any external force being applied to actively rotate the shaft 146. Advantageously, in this configuration, only a single force applied in the longitudinal direction along the longitudinal axis of the shaft 146 may achieve both translation and rotation of the shaft 146 with respect to the bracket 144 so as to pivot the leg member 150 about the longitudinal axis of the shaft 146.

[0020] According to various embodiments, the first cooperative element 144 of the bracket 142 may include a protrusion and the second cooperative element 148 of the shaft 146 may include a groove on a cylindrical surface of the shaft 146. A portion of the groove may form a helical groove on the cylindrical surface of the shaft 146. Accordingly, the first cooperative element 144 may be engaged with the second cooperative element 148 by having the protrusion received in the groove. In this arrangement, when the shaft 146 translates along the longitudinal axis of the shaft 146 with respect to the bracket 142, the protrusion may be slide along the groove. As the protrusion slides along the portion of the groove forming the helical groove, the shaft 146 may be rotated relative to the bracket 142. Accordingly, the interaction between the protrusion and the portion of the groove forming the helical groove may cause the shaft 146 to rotate relative to the bracket 142.

[0021] According to various embodiments, the first cooperative element 144 of the bracket 142 may include a groove on the inner wall of the bracket 142 and the second cooperative element 148 of the shaft 146 may include a protrusion. A portion of the groove on the inner wall of the bracket 142 may form a helical groove. Similarly, the interaction between the protrusion

and the portion of the groove forming the helical groove may cause the shaft 146 to rotate relative to the bracket 142.

[0022] According to various embodiments, the helical groove may be configured to rotate the shaft 146 ninety degrees about the longitudinal axis of the shaft 146 as the shaft 146 translates along the longitudinal axis of the shaft 146. Accordingly, the helical groove may be dimensioned such that a starting point of the helical groove and the ending point of the helical groove are configured to extend across a cylindrical surface of a quadrant of the shaft 146. Further, the helical groove may be configured to rotate the shaft 146 about the longitudinal axis of the shaft 146 at a predetermined relative speed with respect to the speed of translation of the shaft 146 along the longitudinal axis of the shaft 146. Accordingly, a helix angle of the helical groove may be dimensioned to achieve the predetermined relative rotational speed with respect to the speed of translation.

[0023] According to various embodiments, the first cooperative element 144 of the bracket 142 may include a rotator having a protrusion. The rotator may be coupled to the bracket 142 and may be rotatable relative to the bracket 142 about the longitudinal axis of the shaft 146. In this embodiment, the second cooperative element 148 of the shaft 146 may include a linear groove lengthwise on the cylindrical surface of the shaft 146. Accordingly, the first cooperative element 144 may be engaged with the second cooperative element 148 by having the protrusion of the rotator received in the linear groove of the shaft 146. Accordingly, when the rotator is being actuated to rotate relative to the bracket 142, the protrusion of the rotator in engagement with the linear groove may transmit a rotating force to the shaft 146 causing the shaft 146 to rotate about the longitudinal axis of the shaft 146. Further, the linear groove may allow the shaft 146 to be movable, slidable or translatable along the longitudinal axis of the shaft 146 with respect to the rotator. Accordingly, the interaction between the protrusion of the rotator and the linear groove of the shaft 146 may cause the shaft 146 to rotate relative to the bracket 142 while the shaft 146 may move, slide or translate along the longitudinal axis of the shaft 146 with respect to the bracket 142.

[0024] According to various embodiments, the outrigger assembly 140 may further include a rotator actuator coupled to the rotator. The rotator actuator may be configured to rotate the rotator relative to the bracket 142 about the longitudinal axis of the shaft 146. According to various embodiments, the rotator actuator may include a linear actuator. One end of the rotator actuator may be pivotably mounted to the frame 110. Another end of the rotator actuator may be pivotably coupled to the rotator. The rotator actuator may be arranged such that a linear force from the rotator actuator may be transmitted as a tangential force acting on the rotator to rotate the rotator about the longitudinal axis of the shaft 146. Accordingly, the rotator actuator may be

configured to apply a linear force tangent to a circumference of the rotator and which is perpendicular to the longitudinal axis of the shaft 146.

[0025] According to various embodiments, the bracket 142 may further include a protrusion and the shaft 146 may further include a three-sectioned groove. The three-sectioned groove may include a first groove section lengthwise along the shaft, a second groove section perpendicular to the first groove section, and a third groove section lengthwise along the shaft. Accordingly, the three-sectioned groove may include a substantially Z-shape. In this arrangement, the bracket 142 may be engaged with the shaft 146 by having the protrusion of the bracket 142 received in the three-sectioned groove of the shaft 146.

[0026] According to various embodiments, the outrigger assembly 140 may further include a shaft actuator 160 coupled to the shaft 146 and configured to translate the shaft 146 along the longitudinal axis of the shaft 146. Accordingly, one end of the shaft actuator 160 may be coupled to the shaft 146 and another end of the shaft actuator 160 may be coupled to the frame 110. In this embodiment, the shaft actuator 160 may apply a linear force in the longitudinal direction of the shaft 146 to slide, move, or translate the shaft 146 along the longitudinal axis of the shaft 146 relative to the bracket 142 mounted to the frame 110. According to various embodiments, the shaft actuator 160 may be a pneumatic actuator. Accordingly, the shaft actuator may be linked up to a pneumatic suspension mechanism of the truck or the trailer for powering the pneumatic actuator to actuate the shaft 146.

[0027] According to various embodiments, the shaft 146 may include a section with polygonal cross-section and the other sections of the shaft 146 may remain as a cylindrical section. The polygonal cross-section may include a square cross-section, a pentagon cross-section, a hexagonal cross-section, a rectangular cross-section, etc. According to various embodiments, the bracket 142 may define a cavity for receiving the shaft 146. The cavity may have a cross-section corresponding to the polygonal cross-section of the shaft 146. Accordingly, the bracket 142 may include the cavity with the corresponding polygonal cross-section. In this arrangement, as the shaft 146 translates relative to the bracket 142 along the longitudinal axis of the shaft 146, the shaft 146 may be rotatable about the longitudinal axis of the shaft 146 as the cylindrical section of the shaft 146 translates through the polygonal cross-sectioned cavity of the bracket 142. However, when the section of the shaft 146 with the polygonal cross-section reaches and fits into the polygonal cross-sectioned cavity of the bracket 142, the shaft 146 may be locked and prevented from rotating about longitudinal axis of the shaft 146.

[0028] According to various embodiments, the shaft 146 may include at least two sections with polygonal cross-section and at least one other cylindrical section disposed between the at least two sections with polygonal cross-section. In this arrangement, the portion of the groove forming the helical groove may be on the cylindrical surface of the cylindrical section of the

shaft 146. Advantageously, the shaft 146 may be initially locked from rotating when the first section of the shaft 146 with the polygonal cross-section is fitted in the polygonal cross-sectioned cavity of the bracket 142. As the shaft 146 translates through the cavity of the bracket 142, the first section of the shaft 146 with the polygonal cross-section may move out of the cavity and the cylindrical section of the shaft 146 may move through the cavity of the bracket. As the cylindrical section of the shaft 146 moves through the cavity of the bracket 142, the engagement between the second cooperative element 148 of the shaft 146 (i.e. helical groove or linear groove) and the first cooperative element 144 of the bracket 142 (i.e. protrusion or rotator) may cause the shaft 146 to rotate about the longitudinal axis of the shaft 146. Subsequently, as a second of the at least two sections with polygonal cross-section of the shaft 146 moves and fits into the polygonal cross-sectioned cavity of the bracket 142, the shaft 146 may be locked and prevented from rotating about the longitudinal axis of the shaft 146. Advantageously, with the leg member 150 coupled to the end of the shaft 146, the leg member 150 may be locked in a retracted horizontal position when the first of the at least two sections with polygonal cross-section of the shaft 146 is fitted in the polygonal cross-sectioned cavity of the bracket 142. As the cylindrical section of the shaft 146 translates through the polygonal cross-sectioned cavity of the bracket 142, the leg member 150 may be pivoted about the longitudinal axis of the shaft 146. Finally, when the second of the at least two sections with polygonal cross-section of the shaft 146 fits into the polygonal cross-sectioned cavity of the bracket 142, the leg member 150 may be locked in a deployed vertical position.

[0029] According to various embodiments, the outrigger assembly 140 may further include a shaft locking mechanism 152 configured to lock the shaft 146 to the bracket 142. The shaft locking mechanism 152 may include a locking pin configured to be inserted through the bracket 142 and the shaft 146 to lock and prevent the shaft 146 from moving, sliding or translating relative to the bracket 142. According to various embodiments, the shaft locking mechanism 152 may include a pneumatic actuator for pneumatically actuating the locking mechanism 152.

[0030] According to various embodiments, the outrigger assembly 140 may further include a counterweight 154 attached to an end of the leg member 150. Accordingly, the counterweight 154 may be attached to the non-ground-contacting end of the leg member 150. In this arrangement, the counterweight 154 may be located on one side of a pivoting axis of the leg member 150 while the center of gravity of the leg member 150 may be on the opposite side of the pivoting axis of the leg member 150. Advantageously, the counterweight 154 may provide a countering force to control the pivoting of the leg member 150 during deployment of the leg member 150, for example from the horizontal retracted position to the vertical deployed position. Further the counterweight 154 may also contribute to the lifting and rotational force to pivot the leg member 150 during retraction or stowing of the leg member 150, for example from

the vertical deployed position to the horizontal retracted position. During retraction or stowing of the leg member 150, with the aid of the counterweight 154, a relatively smaller force may be required by the shaft actuator 160 to cause a rotation of the shaft 146 for pivoting the leg member 150 back to the horizontal retracted position.

5 **[0031]** According to various embodiments, the apparatus 100 may include a control box 170 mounted to the frame 110. The control box 170 may include a connector configured to connect the control box 170 to an external pneumatic system, for example the pneumatic suspension mechanism of the truck or the trailer. Accordingly, with the various actuation mechanism of the outrigger assembly 140 connected to the control box 170, the control box 170
10 may control and utilize the external pneumatic system to power the various actuation mechanism of the outrigger assembly 140. According to various embodiments, the connections between the control box 170 and the various actuation mechanism of the outrigger assembly 140 may be concealed within the frame 110.

15 **[0032]** According to various embodiments, the control box 170 may further be configured to be operable to control a translation of the shaft 146 along the longitudinal axis of the shaft 146 as means to control the rotation of the shaft 146. Accordingly, the control box 170 may be in connection with the shaft actuator 160. Thus, the control box 170 may utilize the external pneumatic system to power the shaft actuator 160. Further, the control box 170 may include mechanical switches, buttons or levers for the operator to operate and control the shaft actuator
20 160 to translate the shaft 146 along the longitudinal axis of the shaft 146.

25 **[0033]** According to various embodiments, the frame 110 may include an alignment element 112 configured to cooperate with a corresponding alignment component of the truck or the trailer to align the frame 110 to the truck or the trailer for mounting the apparatus 100 to the truck or the trailer. The alignment element 112 may include a protrusion in the form of a conical shape, frusto-conical shape, rounded cone shape etc. The corresponding alignment component of the truck may include a recess with a corresponding shape for receiving the protruding alignment element 112 of the frame 110. With such alignment element 112, as the frame 110 is being mounted to the truck or trailer, the alignment element of the frame 110 may slide into the alignment component of the truck or the trailer such that the frame 110 may be aligned with the
30 truck or the trailer when the frame 110 is mounted to the truck or the trailer.

35 **[0034]** According to various embodiments, the frame 110 may include a locking block 114 configured to cooperate with a corresponding locking block of the truck or the trailer for locking the frame to the truck or the trailer. Accordingly, the frame 110 with the load supported on the apparatus 100 may be secured to the truck or the trailer for transportation. The locking block may include a ISO standard locking block.

[0035] According to various embodiments, the frame 110 may include coupling elements 116 to couple the load to the frame 110. The coupling elements 116 may include ISO container couplings.

[0036] According to various embodiments, the apparatus 100 may further include a tailgate lift assist 120 attached to the frame 110. The tailgate lift assist 120 may facilitate loading and unloading of cargo from the apparatus 100 when the apparatus 100 is standing on its legs.

[0037] According to various embodiments, the apparatus 100 may further include a visual alignment guide 130. The visual alignment guide 130 may include a camera system. The camera system may include a backing camera located behind the cab of the truck or other suitable location. A visual display of the camera system may include pre-drawn lines on a screen or a monitor mounted on a dashboard of the truck to allow the driver to visually use these pre-drawn lines as guide when the camera provide visual image on the screen as the truck reverses into the apparatus 100. According to various embodiments, guide lines and indicators may be painted on the underside of the apparatus 100 to help align with the pre-drawn lines on the screen. Accordingly, the camera system may allow the driver to visually align the truck to the apparatus 100.

[0038] According to various embodiments, the apparatus 100 may further include a further outrigger assembly 180 mounted to the frame 110. The further outrigger assembly 180 may include a leg housing 182 coupled to the frame 110. The leg housing 182 may be disposed such that the leg housing 182 may be at least substantially perpendicular to the frame 110. For example, the leg housing 182 may extend vertically downward from a horizontally disposed frame 110. The further outrigger assembly 180 may include an inner leg member 184 slidably received inside the leg housing 182. The inner leg member 184 may be slidable relative to the leg housing 182 in a telescopic manner. The further outrigger assembly 180 may further include a leg locking mechanism 186 configured to lock the inner leg member 184 to the leg housing 182. In a retracted position, the inner leg member 184 may be fully inserted into the leg housing 182. In a deployed position, the inner leg member 184 may be extended out longitudinally from the leg housing 182. The leg locking mechanism 186 may lock the inner leg member 184 to the leg housing 182 in the retracted position or the deployed position. The further outrigger assembly 180 may include a leg actuator 188 coupled to the inner leg member 184. The leg actuator 188 may be configured to provide a linear force to the inner leg member 184 in the longitudinal direction of the leg housing 182 so as to slide the inner leg member 184 longitudinally relative to the leg housing 182.

[0039] According to various embodiments, the further outrigger assembly 180 may include a leg biasing element 190 coupled to the leg housing 182. The leg biasing element 190 may be configured to provide a biasing force against the inner leg member 184 in the leg retracted

position. The leg biasing element 190 may include spring, a block of resilient material or the like. Accordingly, the leg biasing element 190 may serve to provide a cushioning force during retraction of the inner leg member 184. Further, when the power of the leg actuator 188 is turned off after the inner leg member 184 is in the retracted position, the leg biasing element 190 may also serve to push the inner leg member 184 against a locking pin of the leg locking mechanism 186 to clamp the locking pin between the inner leg member 184 and the leg housing 182. Advantageous, the leg biasing element 190 may clamp the locking pin sufficiently tightly between the leg housing 182 and the inner leg member 184 to prevent accidental dislodgement of the locking pin due to vibration during transportation.

[0040] According to various embodiments, the further outrigger assembly 180 may further include an arm housing 192 mounted to the frame 110. The arm housing 192 may be at least substantially parallel to the frame 110. The further outrigger assembly 180 may further include an inner arm member 194 slidably received inside the arm housing 192. The inner arm member 194 may be slidable relative to the arm housing 192 in a telescopic manner. The leg housing 182 may be coupled to an end of the inner arm member 194 and the leg housing 182 may be at least substantially perpendicular to the inner arm member 194. Since the arm housing 192 may be at least substantially parallel to the frame 110, the leg housing 182 may then be at least substantially perpendicular to the frame 110. Accordingly, in a horizontally disposed frame 110, the arm housing 192 may be at least substantially horizontal and the leg housing 182 may extend vertically downward from the frame 110. According to various embodiments, the further outrigger assembly 180 may further include an arm locking mechanism 196 configured to lock the inner arm member 194 to the arm housing 192.

[0041] In a retracted position, the inner arm member 194 may be fully inserted into the arm housing 192. In a deployed position, the inner arm member 194 may be extended out longitudinally from the arm housing 192. The arm locking mechanism 196 may lock the inner arm member 194 to the arm housing 192 in the retracted position or the deployed position. The further outrigger assembly 180 may include an arm actuator 198 coupled to the inner arm member 194. The arm actuator 198 may be configured to provide a linear force to the inner arm member 194 in the longitudinal direction of the arm housing 192 so as to slide the inner arm member 194 longitudinally relative to the arm housing 192. Advantageously, with the arm housing 192 and the inner arm member 194 arrangement, the further outrigger assembly 180 may extend laterally from the frame 110 so as to provide a wider stance for supporting the load on the apparatus 100 to enhance the stability.

[0042] According to various embodiments, the further outrigger assembly 180 may include an arm biasing element 191 coupled to the arm housing 192. The arm biasing element 191 may be configured to provide a biasing force against the inner arm member 194 in the arm retracted

position. The arm biasing element 191 may include spring, a block of resilient material or the like. Accordingly, the arm biasing element 191 may serve to provide a cushioning force during retraction of the inner arm member 194. Further, when the power of the arm actuator 198 is turned off after the inner arm member 194 is in the retracted position, the arm biasing element 191 may also serve to push the inner arm member 194 against a locking pin of the arm locking mechanism 196 to clamp the locking pin between the inner leg member 194 and the leg housing 192. Advantageous, the arm biasing element 191 may clamp the locking pin sufficiently tightly between the arm housing 192 and the inner arm member 194 to prevent accidental dislodgement of the locking pin due to vibration during transportation.

[0043] According to various embodiments, the shaft locking mechanism 152, the leg locking mechanism 186 or the arm locking mechanism 196 may include a locking pin. Accordingly, the shaft locking mechanism 152 may include a locking pin configured to be interlocked between the bracket 142 and the shaft 146. The leg locking mechanism 186 may include a locking pin configured to be interlocked between the leg housing 182 and the inner leg member 184. The arm locking mechanism 196 may include a locking pin configured to be interlocked between the arm housing 192 and the inner arm member 194.

[0044] According to various embodiments, the locking pin of the respective locking mechanism may be configured to move between a pin retracted position (or a released position) and a pin extended position (or a locked position). In the pin retracted position, the locking pin may be retracted such that the locking pin of the respective locking mechanism may no longer be interlocking the bracket 142 and the shaft 146, or the leg housing 182 and the inner leg member 184, or the arm housing 192 and the inner arm member 194 respectively. In the pin extended position, the locking pin of the respective mechanism may be extended such that the locking pin may be interlocking the bracket 142 and the shaft 146, or the leg housing 182 and the inner leg member 184, or the arm housing 192 and the inner arm member 194 respectively.

[0045] According to various embodiments, the shaft locking mechanism 152, the leg locking mechanism 186 or the arm locking mechanism 196 may include a pin biasing element configured to provide a biasing force against the locking pin of the respective locking mechanism in the pin retracted position when the pin is fully retracted. Accordingly, a deliberate force must be applied to the locking pin of the respective locking mechanism to move the locking pin to fully retract the pin in order to unlock the shaft 146 from the bracket 142, or the inner leg member 184 from the leg housing 182, or the inner arm member 194 from the arm housing 192 respectively. Thus, the pin biasing element of the respective locking mechanism may serve as a safety element to prevent any accidental movement of the locking pin of the respective locking mechanism to unlock the respective components because a deliberate force

must always be applied to fully move the locking pin to the pin retracted position in order to unlock the respective components.

[0046] According to various embodiments, the shaft locking mechanism 152, the leg locking mechanism 186 or the arm locking mechanism 196 may include a lock actuator configured to actuate the locking pin of the respective locking mechanism between the pin retracted position and the pin extended position.

[0047] According to various embodiments, the shaft locking mechanism 152, the leg locking mechanism 186 or the arm locking mechanism 196 may include a guide member with an elongated guide slot, and a slider member with an elongated slider slot. The locking pin may be configured to engage with the elongated guide slot and the elongated slider slot. Further, the locking pin may be engaged to the elongated guide slot with the elongated guide slot parallel to a longitudinal axis of the locking pin. The locking pin may also be engaged to the elongated slider slot with the elongated slider slot at an angle with respect to the longitudinal axis of the locking pin. Furthermore, the slider member may be movable relative to the guide member. In this arrangement, a relative linear movement between the slider member and the guide member may cause the locking pin to move linearly relative to the guide member in a direction at least substantially perpendicular to the direction of relative linear movement between the slider member and the guide member. Accordingly, a vertical relative movement between the slider member and the guide member may cause the pin to move horizontally relative to the guide member. Advantageously, this arrangement may provide a slim and effective locking mechanism for locking the respective components.

[0048] According to various embodiments, the locking pin may include a protruding element extending from the locking pin, and the protruding element may be at least substantially perpendicular to the longitudinal axis of the locking pin. Accordingly, the protruding element of the locking pin may be engaged to the elongated guide slot of the guide member and the elongated slider slot of the slider member so as to cause the locking pin to move linearly relative to the guide member in a direction at least substantially perpendicular to the direction of relative linear movement between the slider member and the guide member.

[0049] According to various embodiments, the shaft locking mechanism 152, the leg locking mechanism 182 or the arm locking mechanism 192 may be configured to be pneumatically actuated. Accordingly, the lock actuator of the respective locking mechanism may include a pneumatic actuator. The respective pneumatic actuator may be coupled to the respective locking pin for moving the respective locking pin. Further, the respective pneumatic actuator may be connected to the control box 170 such that actuation of the pneumatic actuator may be controlled via the control box 170.

[0050] FIG. 2 illustrates a method 200 of off-loading a load from a truck or a trailer with the load supported by the apparatus as described herein and with the apparatus mounted to the truck or the trailer. At 202, the method may include raising the truck or the trailer, using a height adjustment mechanism of the truck or the trailer, to raise the frame of the apparatus. At 204, the method may include deploying the leg member of the outrigger assembly of the apparatus. At 206, the method may include lowering the truck or the trailer, using the height adjustment mechanism of the truck or the trailer, to lower the frame of the apparatus for the leg member to contact a ground. At 208, the method may include lowering the truck or the trailer, using the height adjustment mechanism of the truck or the trailer, to detach the apparatus from the truck or the trailer.

[0051] According to various embodiments, the method may further include unlocking the frame of the apparatus from the truck or the trailer.

[0052] According to various embodiments, the height adjustment mechanism of the truck or the trailer may include a pneumatic suspension mechanism.

[0053] According to various embodiments, deploying the leg member of the outrigger assembly of the apparatus may include using the pneumatic suspension of the truck or the trailer to deploy the leg member of the outrigger assembly of the apparatus.

[0054] According to various embodiments, deploying the leg member of the outrigger assembly of the apparatus may include unlocking the leg member of the outrigger assembly of the apparatus using the pneumatic suspension of the truck or the trailer.

[0055] FIG. 3 shows a detachable/demountable truck bodies system 301 utilising an apparatus 300 for supporting a load 302 and for detachably mounting to a truck or a trailer. As shown, the apparatus 300 may include a frame 310 configured to support the load 302 and configured to be detachably mounted to the truck or the trailer 304. As shown, the load 302 may be a cargo with ISO containerized frame. It is understood that the load 302 supported by the apparatus 300 may be any types of load. The frame 310 of the apparatus 300 may be configurable such that the load 302 may be attached to the frame 310. As shown, the frame 310 of the apparatus 300 may be mounted to a trailer 304. It is understood that the apparatus may also be mounted to a chassis of a truck or the like. The frame 310 may be configurable such that the apparatus 300 may be detachably mounted to the trailer 304 such that the frame 310 may be separable from the trailer 304. Accordingly, when the apparatus 300 is separated from the trailer 304, the load 302 which is supported on the frame 310 may remain on the apparatus while the trailer 304 may be used for transporting other loads.

[0056] FIGs. 4A, 4B and 4C show a perspective view, a top view and a side view of an apparatus 400 for supporting a load and for detachably mounting to a truck or a trailer according to various embodiments. As shown, the apparatus 400 may include a frame 410, which may be

configured to support the load and configured to be detachably mounted to the truck or a trailer. The frame may include a plurality of support beams 409. Further, the apparatus 400 is shown to include two pairs of outrigger assembly 440 mounted to the frame 410. Each of the outrigger assembly 440 may include a bracket 442 in the form of a square tubular housing mounted to the frame 410. A shaft 446 may be movably received in the bracket. The shaft 446 may be translatable and rotatable relative to the bracket 442. The bracket 442 may include a first cooperative element (see for example FIGs. 11A to 11B and FIGs. 17A to 17C), and the shaft may include a second cooperative element (see for example FIGs. 11A to 11B and FIGs. 17A to 17C). A leg member 450 may be coupled to an end of the shaft 446 and the leg member 450 may be at least substantially perpendicular to the shaft 446. According to various embodiments, the first cooperative element of the bracket 442 and the second cooperative element of the shaft 446 may be engaged with each other and configured to rotate the shaft 446 relative to the bracket 442 about a longitudinal axis of the shaft 446 so as to pivot the leg member 450 about the longitudinal axis of the shaft 446. According to various embodiments, the first cooperative element of the bracket 442 and the second cooperative element of the shaft 446 may be configured to allow the shaft 446 to move, slide or translate relative to the bracket 442 along the longitudinal axis of the shaft 446.

[0057] As shown in FIG. 4C, the shaded leg member 450 illustrates the leg member 450 in a retracted position, and the solid lined leg member 450 illustrates the leg member 450 in a deployed position. In the retracted position, the leg member 450 may be at least substantially horizontal with respect to a ground. In the deployed position, the leg member 450 may be at least substantially vertical with respect to the ground. As illustrated, the leg member 450 may be pivoted about the longitudinal axis of the shaft 446 from the retracted position to the deployed position, and vice versa. According to various embodiments, the leg member 450 may be pivoted through at least substantially 90 degrees from the retracted position to the deployed position, and vice versa.

[0058] As shown in FIG. 4A and 4C, the outrigger assembly 440 may further include a counterweight 454 attached to an end of the leg member 450. As shown, the counterweight 454 may be attached to the non-ground-contacting end of the leg member 450. Accordingly, the counterweight 454 may be located on one side of a pivoting axis of the leg member 450, which is the longitudinal axis of the shaft 446, while the center of gravity of the leg member 450 may be on the opposite side of the pivoting axis of the leg member 450. Advantageously, the counterweight 454 may provide a countering force to control the pivoting of the leg member 450 during deployment of the leg member 450, for example from the retracted position to the deployed position. Further, the counterweight 454 may also contribute to the lifting and rotational force to pivot the leg member 450 during retraction or stowing of the leg member 450,

for example from the deployed position to the retracted position. Accordingly, during retraction or stowing of the leg member 450, with the aid of the counterweight 454, a relatively smaller linear force may be required by the shaft actuator and/or the rotator actuator to cause a rotation of the shaft 446 for pivoting the leg member 450 back to the retracted position.

5 **[0059]** As shown in FIG. 4A, the apparatus 400 may include a control box 470 mounted to the frame 410. The control box 470 may include a connector configured to connect the control box to an external pneumatic system. The control box 470 may also be configured to be in connection with a shaft actuator and/or the rotator actuator which may be configured to actuate the shaft 446 to translate along the longitudinal axis of the shaft 446 such that the first
10 cooperative element and the second cooperative element may rotate the shaft 446. The control box 470 may be configured to utilize the external pneumatic system to power the shaft actuator. Further, the control box 470 may include switches, buttons or levers for the operator to control the shaft actuator. Accordingly, the control box 470 may be configured to be operable to control a translation of the shaft 446 along the longitudinal axis of the shaft 446 as means to control the
15 rotation of the shaft 446.

[0060] As shown in FIG. 4A and 4B, the frame 410 may include an alignment element 412 configured to cooperate with a corresponding alignment component of the truck or the trailer to align the frame 410 to the truck or the trailer for mounting the apparatus 400 to the truck or the trailer. The frame 410 may also include a locking block 414 configured to cooperate with a
20 corresponding locking block of the truck or the trailer for locking the frame to the truck or the trailer.

[0061] FIG. 5 shows a truck 504 with a bare chassis 511, which is generally known as an 'empty truck chassis and cab', 'cab chassis' or 'chassis cab'. The chassis 511 may include support structures 509. As shown, the chassis 511 may include alignment components 513
25 which may be configured to cooperate with the alignment element 412 of the apparatus 400 so as to align the frame 410 to the chassis 511 for mounting the apparatus 400 to the truck 504. The chassis 511 may also include a locking block 515 which may be configured to cooperate with the locking block 414 of the apparatus 400 so as to lock the frame 412 of the apparatus 400 to the chassis 511 of the truck 504. Further, the truck 504 may include a pneumatic suspension
30 mechanism 571 which may be connected to the control box 470 of the apparatus 400. Further, the pneumatic suspension mechanism 571 may also be configured to lift the frame 410 of the apparatus 400 for deploying of the outrigger assembly 440 of the apparatus 400.

[0062] FIGs. 6A and 6B show a detachable/demountable truck bodies system 401 and illustrate the deployment of the outrigger assembly 440 of the apparatus 400 when mounted on
35 the truck 504 according to various embodiments. As shown in FIG. 6A, when the apparatus 400 is mounted on the truck 504, the frame 410 of the apparatus 400 may be resting on the chasis

511 of the truck 504. The alignment element 412 of the apparatus 400 may be fitted to the alignment component 513 of the truck 504. The locking block 414 of the apparatus 400 may also be coupled to the locking block 515 of the truck 504. In addition, the leg member 450 of the outrigger assembly 440 of the apparatus 400 may be in the retracted position. Accordingly, the apparatus 400 and any load supported on the apparatus 400 may be transported by the truck 504.

[0063] In FIG. 6B, the apparatus 400 may be raised by the pneumatic suspension mechanism 571 of the truck 504 such that the frame 410 of the apparatus 400 may be lifted a distance above the chassis 511 of the truck 504. Accordingly, the alignment element 412 of the apparatus 400 may be separated from the alignment component 513 of the truck 504. The locking block 414 of the apparatus 400 may also be decoupled from the locking block 515 of the truck 504. With the apparatus 400 lifted from the chassis 511 of the truck 504, the leg member 450 of the outrigger assembly 440 may be pivoted about the longitudinal axis of the shaft 446 from the retracted position to the deployed position.

[0064] FIGs. 7A and 7B show an apparatus 700 for supporting a load and for detachably mounting to a truck or a trailer according to various embodiments. As shown, the apparatus 700 may include a frame 710, which may be configured to support the load and configured to be detachably mounted to the truck or a trailer. Further, the apparatus 700 is shown to include two pairs of outrigger assembly 780 mounted to the frame 710. Each of the outrigger assembly 780 may include a leg housing 782 coupled to the frame 710. An inner leg member 784 may be slidably received inside the leg housing 782. Accordingly, the inner leg member 784 may be slidable relative to the leg housing 782 in a telescopic manner. Further, the outrigger assembly 780 may include a leg locking mechanism 786 mounted to the leg housing 782. The leg locking mechanism 786 may be configured to lock the inner leg member 784 to the leg housing 782. According to various embodiments, the outrigger assembly 780 may include a leg actuator (not shown) coupled to the inner leg member 784. The leg actuator may actuate the inner leg member 784 to slide relative to the leg housing 782. Accordingly, the leg actuator may retract the inner leg member 784 into the leg housing 782 such that the inner leg member 784 is in a retracted position as shown in FIG. 7A. The leg actuator may also extend the inner leg member 784 out of the leg housing 782 such that the inner leg member 784 is in the deployed position as shown in FIG. 7B.

[0065] As shown in FIGs. 7A and 7B, similar to the apparatus 400 of FIGs. 4A, 4B and 4C, the apparatus 700 may include control box 770 mounted to the frame 710. The control box 770 may include a connector configured to connect the control box to an external pneumatic system. The control box 770 may also be configured to be in connection with the leg actuator for actuating the inner leg member 784. The control box 770 may be configured to utilize the external pneumatic system to power the leg actuator to actuate the inner leg member 784.

Further, the frame 710 may include an alignment element 712 configured to cooperate with a corresponding alignment component of the truck or the trailer to align the frame 710 to the truck or the trailer for mounting the apparatus 700 to the truck or the trailer. The frame 710 may also include a locking block 714 configured to cooperate with a corresponding locking block of the truck or the trailer for locking the frame to the truck or the trailer.

[0066] FIGs. 8A and 8B show a detachable/demountable truck bodies system 801 and illustrate the deployment of the outrigger assembly 780 of the apparatus 700 when mounted on the truck 504 according to various embodiments. As shown in FIG. 8A, when the apparatus 700 is mounted on the truck 504, the frame of the apparatus 700 may be resting on the chassis 511 of the truck 504. The alignment element 712 of the apparatus 700 may be fitted to the alignment component 513 of the truck 504. The locking block 714 of the apparatus 700 may also be coupled to the locking block 515 of the truck 504. In addition, the inner leg member 784 of the outrigger assembly 780 of the apparatus 700 may be in the retracted position. Accordingly, the apparatus 700 and any load supported on the apparatus 700 may be transported by the truck 504.

[0067] In FIG. 8B, the apparatus 700 may be raised by the pneumatic suspension mechanism 571 of the truck 504 such that the frame 710 of the apparatus 700 may be lifted a distance above the chassis 511 of the truck 504. Accordingly, the alignment element 712 of the apparatus 700 may be separated from the alignment component 513 of the truck 504. The locking block 714 of the apparatus 700 may also be decoupled from the locking block 515 of the truck 504. With the apparatus 700 lifted from the chassis 511 of the truck 504, the inner leg member 784 of the outrigger assembly 780 may be extended from the leg housing 782 from the retracted position to the deployed position.

[0068] According to various embodiments, an apparatus for supporting a load and for detachably mounting to a truck or a trailer may include the outrigger assembly 440 of apparatus 400 as well as the outrigger assembly 780 of the apparatus 700. Accordingly, such apparatus may include an outrigger assembly with a pivoting leg member and a further outrigger assembly with a vertically extendable leg member. According to various embodiments, the apparatus for support a load and for detachably mounting to a truck or a trailer may include a pair of outrigger assembly with a pivoting leg and a further pair of outrigger assembly with a vertically extendable leg member.

[0069] FIG. 9 shows a method 901 of off-loading a load 902 from a truck 904 with the load 902 supported by an apparatus 900 for supporting a load and for detachably mounting to a truck or a trailer according to various embodiments. As shown, the apparatus 900, with the load 902 supported on the apparatus 900, may be initially mounted to the truck 904 during transportation. When the truck 904 carrying the apparatus 900 and the load 902 reach the desired destination, the chassis 911 of the truck 904 may be raised using a height adjustment mechanism, for

example the suspension system, of the truck 904. With the chassis 911 of the truck 904 raised, the apparatus 900 with the frame 910 coupled to the chassis 911 may be raised. In the raised position, the leg members 984 of the outrigger assemblies 980 of the apparatus 900 may be deployed. In FIG. 9, the outrigger assemblies 980 are shown to be of the type with the vertically extendable leg member for illustration purposes only. It is understood that the apparatus 900 may also include outrigger assembly with pivoting leg member similar to the outrigger assembly 440 of the apparatus 400 as shown in FIGs. 4A, 4B and 4C. Similarly, the pivoting leg member may be deployed when the apparatus 900 is in the raised position. After the leg members of the outrigger assemblies are deployed, the chassis 911 of the truck 904 may be lowered using the height adjustment mechanism of the truck 904. Accordingly, as the chassis of the truck 904 is being lowered, the leg members 984 of the outrigger assemblies 980 of the apparatus 900 may contact the ground. As the chassis 911 of the truck 904 continues to lower, the chassis 911 may be separated from the apparatus 900 while the apparatus 900 with the load 902 remains standing on the ground. Accordingly, the truck 904 may be detached from the apparatus 900, which may support the load 902 from the ground, such that the truck 904 may move off to pick up the next cargo or load. The load 902 on the apparatus 900 may then be free standing such that loading and/or unloading may take place without time pressure.

[0070] FIG. 10 shows an apparatus 1000 for supporting a load and for detachably mounting to a vehicle, such as a truck or a trailer or a heavy goods vehicle (HGV). The apparatus 1000 may be adapted to be completely separable from the truck or the trailer or the heavy goods vehicle (HGV), to which the apparatus 1000 may be intended to be carried on, and operatively connected to. In addition, the apparatus 1000 may allow the load, such as a filled transport container, a detachable HGV body, or goods, which is to be carried by the truck or trailer, to be mounted on top of the goods supportable rectangular frame 1010, to freely stand on the apparatus 1000, when the apparatus 1000 is in its fully deployed position.

[0071] The frame 1010 may be mounted to the proximal end of six (in some configurations – typically smaller vehicles, only four are needed), elongate, pneumatically moveable outrigger arms 1040 (or outrigger assembly) which may be able to slide from a stowed to a deployed position. During the translational sliding motion, they are also able to rotate at least substantially through 90°, rotation occurring only when translational.

[0072] FIG. 11A shows an assembled view 1001 of the outrigger arm 1040 in a completely retracted and stowed position. FIG. 11A also shows an exploded view 1003 of the outrigger arm 1040 in a completely retracted and stowed position. FIG. 11B shows a perspective view 1105 of the outrigger arm 1040 in a fully deployed and extended position. FIG. 12 shows a side view 1201 and a perspective view 1203 of a shaft of the outrigger arm of FIG. 10 according to various embodiments. Each outrigger arm 1040 may include the following major components. A

hollow shaft 1046 as shown in FIG. 12 with alternating circular 1045 and square 1047 cross sections, and four milled guide key slots 1048 (or grooves); a pneumatic cylinder 1060 (or a shaft actuator) having a pneumatic rod, and means of securing the pneumatic rod of pneumatic cylinder 1060 located within the shaft 1046 which, when in the stowed position, the pneumatic cylinder 1060 rests inside the hollow portion of the shaft 1046; a leg 1050 of hollow square cross section; a solid circular section leg-mounting shaft 1049 located at the distal end of the hollow shaft 1046 which the leg 1050 may be welded to; a mounting plate 1041, an upper face of the mounting plate 1041 which, at its proximal end maybe mounted to a right angled mounting bracket 1043 (which may secure the fixed end of the outrigger arm's pneumatic deployment piston 1060) may be welded to the underside of the frame 1010; and two hollow square collars 1042 (or brackets), also secured to the lower face of mounting plate 1041.

[0073] Together these two hollow square collars 1042 each may have two location holes 1024 for guide key bolts 1044. FIG. 13 shows a guide key bolt 1044, a front view 1301 of the collar 1042, a side view 1303 of the collar 1042, and a perspective view 1305 of the collar 1042 according to various embodiments. As shown, the hollow square collars 1042 may include a cavity 1027. The cavity 1027 may include a square cutout that may prevent rotation of outrigger shaft 1046 once the square portion of the shaft 1046 is seated in the square cavity 1027. Further, the guide key bolts 1044 inserted through the guide key hole 1024 of the collar 1042 may directly fit into and cooperate with the guide key slots 1048 milled into the outrigger arm shaft 1046 and cause the outrigger arm shaft 1046 to rotate at least substantially through 90° as it slides longitudinally by force of the pneumatic piston 1060. Four lock bolt mounting holes 1025 together with a lock bolt hole 1026 may be located on one face of each square collar 1042 to accommodate a lock-bolt mechanism 1052, which may be pneumatically actuated, the lock bolt of which may be return spring biased towards and adapted to pass through the lock bolt hole 1026 to secure the outrigger arm 1040 either in its stowed or deployed position. A pull ring 1053 may be provided for use in manual operation.

[0074] Each square collar 1042 may be so dimensioned as to provide a clearance sliding fit for the square cross-section 1047 of shaft 1046, and thus may snugly fit the square cross section 1047 portion of the shaft 1046 to prevent any further rotation of the outrigger arm, once this square cross-sectional portion 1047 of shaft 1046 has entered the collar 1042.

[0075] FIG. 16D shows another embodiment of the leg member 1050 of the outrigger arm 1040 in a deployed vertical position 1601 and a retracted horizontal position 1603. The weight of the ground contactable leg 1050 forming part of the outrigger arm 1040 may be relatively heavy and in order to ensure that pneumatic operation of the outrigger arm 1040, the leg member 1050 may be provided with a counterbalance weight 1054 at its non-ground-contacting end as shown in FIG. 16D. This may ensure that a relatively small pneumatic pump in the

outrigger arm 1040 may be capable of lifting/rotating the leg member 1050 as the counter-balance weight 1054 on the other side of the pivot point 1053 may assist in the 'lift/rotation' of the leg member 1050 during movement especially from its deployed to its stowed position.

[0076] The apparatus 1000 may be provided a main control box 1070 and sub-control box 1071 (intended to be located away from moving parts for safety reasons) which serves as a means of:

a) conveniently linking the pneumatic system of the truck or trailer to the pneumatic systems 1060 of the apparatus 1000; and

b) actuation for the combined apparatus 1000 and the truck or the trailer system which may enable the truck or the trailer to rapidly off-load the goods it may be carrying.

[0077] FIG. 14A shows the main control box 1070 and the sub control box 1071. The main control box 1070 may include a pair of mechanical valves 1072, 1073:

- i) the first valve 1072, for the simultaneous release of lock bolts; and
- ii) the second valve 1073, for the simultaneous control, deployment and return of all of the outrigger arms 1040.

[0078] The main control box 1070 may also contains the two additional selector rotary switches 1074, 1075:

[0079] i) the first rotary switch 1074 may allow the operator to select either 4-leg (as shown in FIG. 16C) or 6-leg (as shown in FIG. 16B) operations depending on the load. In the case where the apparatus only has 4 legs (typically for smaller or lighter HGVs), the rotary switch 1073 may be removed; and

[0080] ii) the second rotary switch 1075 may be the Air-Master ON/OFF switch which may provide or shut off air to the pneumatic systems within the apparatus 1000 prior to the truck or trailer moving between locations, or when the apparatus 1000 is static – i.e. not moving.

[0081] Referring to FIG. 10, essentially a 10mm hose 1076 (or connector) connected to the truck or the trailer pneumatic system may enter the main control box 1070 and a bundle of hoses 1077 may exit the control box 1070. The hoses 1077 employed throughout may be colour coded to aid identification if there is a problem.

[0082] FIG.s 15A to 15I illustrate the apparatus 1000 described above mounted to and operatively connected to a truck 1504 to form a system which acts together. The system illustrated includes truck 1504, such as an empty truck chassis and cab or chassis unit, fitted with the apparatus 1000, and a load 1502 mounted to the apparatus 1000. When fully deployed, the apparatus 1000 may enable the chassis unit to drive away while the load 1502 and the apparatus 1000 remain standing on the leg members 1050 of the apparatus 1000.

[0083] The system may be primarily employed where it is desirable to allow the load to be loaded and unloaded at a raised loading bay platform while standing directly on the deployed

apparatus 1000. The detached chassis unit can then be driven to pick up a different load which may be ready for delivery. The system may allow the chassis unit to switch out and pick up a different load and increase the efficiency of the truck use and lower overall costs.

[0084] A method 1501 of operating the system is also shown in FIGs 15A to 15I and is summarised in the following.

[0085] Deployment operation according to various embodiments is described in the following with reference to FIGs. 15A to 15E and FIGs. 14B to 14F.

[0086] The truck 1504 with the apparatus 1000 and the load 1502 may come to a complete stop on flat ground – typically backed up to a loading bay. While the load 1502, such as a cargo pod, is still resting firmly on the frame 1010 detachably mounted to the chassis 1511, the securing devices or lock that secures the frame to the chassis are disengaged. The apparatus 1000 may be in a fully stowed and retracted position as shown in FIG. 16A.

[0087] The truck 1504 may then be raised on its pneumatic suspension system to its highest possible level (or a height determined by the operator depending on conditions) and locked in place, as shown in FIG. 15A, with the engine still running. The running of the engine may provide compressed air for operation of the pneumatic system to deploy the outrigger arm 1040 of the apparatus 1000 as shown in FIG. 15B. The operator may first ensure that the master switch 1075 is in the “ON” position to supply compressed air to the pneumatic system to the apparatus 1000. The operator may then push and hold down lock-bolt valve actuator 1072 to disengage the lock bolt mechanisms 1052 and move them from their locked to their unlocked position as shown in FIG. 14B.

[0088] The operator may then rotate the outrigger arm deployment switch 1073 to the deploy which causes the outrigger shafts 1046 to slidably extend relative to the collars 1042 to their fully extended position at the same time rotate at least substantially through 90° so that the leg members 1050 move from their stowed position along the horizontal plane to their deployed position in the vertical plane as shown in FIGs. 14C to 14E.

[0089] The operator may then release valve actuator 1072 causing the locking bolt mechanisms 1052 to move from their unlocked to their locked position as shown in FIG. 14F. The operator may then rotate the master switch 1075 to its “OFF” position and then disconnects the 10mm hose connector 1078 from the truck chassis 1511. The operator may finally pneumatically lower the suspension of the chassis of the truck 1504 to its lowest point as shown in FIG. 15C and may then be able to safely drive the chassis away (as shown in FIG. 15D) now that the load 1502 is free standing on the apparatus 1000 (as shown in FIG. 15E).

[0090] Stowing Operation according to various embodiments is described in the following with reference to FIGs. 15F to 15I.

[0091] The operator may pneumatically lower the chassis to its lowest position, and positions the chassis directly below the apparatus 1000 supporting a load 1502, and aligned correctly as shown in FIG. 15F. Subsequently, the operator may pneumatically raise the chassis to its highest position (as shown in FIG. 15G) and secures the chassis to the frame 1010 of the apparatus 1000 by means of their locking system and connects the 10mm hose connector 1078 to the apparatus 1000, followed by turning the master switch 1075 into the “ON” position. The operator may then press and hold down valve actuator 1072, to release the lock bolt mechanisms 1052 from their locked position.

[0092] The operator may then rotate the outrigger arm deployment selector switch 1073 to the “Retract” position which may cause the leg members 1050 of the outrigger arms 1040 to rotate up from the vertical plane at least substantially through 90° to the horizontal plane as the shaft 1046 retract inwards and both of the square cross sections 1047 re-engage their respective stowed collars 1042. The operator may then release valve actuator 1072 causing the locking bolt mechanisms 1052 to move from their unlocked to their locked position, preventing the shaft 1046 from potentially sliding/deploying.

[0093] The operator may then rotate the master switch 1075 to its “OFF” position. The operator may then be in a position to secure or lock the frame 1010 to the chassis 1511 (as shown in FIG. 15H) and lower the chassis 1511 to the normal driving position before driving away (as shown in FIG. 15I).

[0094] The system may be operated by a single person and (excluding chassis raising and lowering) may have a cycle time of less than 30 seconds which greatly reduces the turn-around time for both loading and unloading and may be used with the chassis of a single (rigid) truck or the chassis of an articulated truck.

[0095] This stowing operation may be used not only to connect an empty (non-loaded HGV body) apparatus 1000, but one supporting a load. The system may so be adapted to be able to carry a static load of 4 tons per leg, which when combined typically exceeds the maximum cargo weight of a HGV by at least two times. A manual override system may also be in place enabling deployment of the outriggers arms 1040 from their stowed to their deployed positions to be possible in case the pneumatic system fails.

[0096] FIG. 17A shows an outrigger arm 1740 in a completely retracted and stowed position according to various embodiments. FIG. 17B shows the outrigger arm 1740 in a partial deployed position according to various embodiments. FIG. 17C shows the outrigger arm 1740 in a fully deployed and extended position according to various embodiments. FIG. 17D shows a bracket 1742 of the outrigger arm 1740 according to various embodiments. FIG. 17E shows an assembled view 1701 of a rotator actuator and a rotator of the outrigger arm 1740 according to

various embodiments. FIG. 17F shows a shaft actuator and a shaft of the outrigger arm 1740 according to various embodiments.

[0097] As shown, the outrigger assembly 1740 may include a bracket 1742. The bracket 1742 may be in the form of a square bracket. The bracket 1742 may include a first cooperative
5 element. The first cooperative element may be in the form of a rotator 1744 coupled to the bracket 1742. The rotator 1744 may be in the shape of a circular ring having a protrusion. The protrusion may be a bolt inserted through a hole 1721 in a circumferential wall of the rotator 1744. The rotator 1744 may include a flange portion 1731 on an external surface of the circumferential wall of the rotator 1744. The bracket 1742 may include a L-shape plate 1733 for
10 receiving the flange portion 1731 of the rotator 1744 such that the rotator 1744 may be rotatably coupled to the bracket 1742. Accordingly, the rotator 1744 may be rotatable relative to the bracket 1742 about the longitudinal axis of the shaft 1746

[0098] As shown, the outrigger assembly 1740 may further include a shaft 1746 movably received in the bracket 1742. The shaft 1746 may also be received in an inner cavity of the
15 rotator 1744. The shaft 1746 may include a second cooperative element. The second cooperative element may include a linear groove 1748 on a cylindrical surface of the shaft 1746 and may be parallel to the longitudinal axis of the shaft 1746. The outrigger assembly 1740 may further include a leg member 1750 coupled to an end of the shaft 1746 and the leg member 1750 may be at least substantially perpendicular to the shaft 1746. According to various embodiments, the
20 rotator 1744 of the bracket 1742 and the linear groove 1748 of the shaft 1746 may be engaged with each other and may be configured to be operable to rotate the shaft 1746 about the longitudinal axis of the shaft 1746. The engagement of the rotator 1744 of the bracket 1742 and the linear groove 1748 of the shaft 1746 may also allow the shaft 1746 to move, slide or translate relative to the bracket 1742 along the longitudinal axis of the shaft 1746.

[0099] Accordingly, the first cooperative element of the bracket 1742 may be engaged with the second cooperative element of the shaft 1746 by having the protrusion of the rotator 1744 received in the linear groove 1748 of the shaft 1746. In this arrangement, when the rotator 1744 is being actuated to rotate relative to the bracket 1742, the protrusion of the rotator 1744 in engagement with the linear groove 1748 may transmit a rotating force to the shaft 1746 causing
30 the shaft 1746 to rotate about the longitudinal axis of the shaft 1746. Further, the linear groove 1748 may allow the shaft 1746 to be movable, slidable or translatable along the longitudinal axis of the shaft 1746 with respect to the rotator 1744. Accordingly, the interaction between the protrusion of the rotator 1744 and the linear groove 1748 of the shaft 1746 may cause the shaft 1746 to rotate relative to the bracket 1742 while the shaft 1746 may move, slide or translate
35 along the longitudinal axis of the shaft 1746 with respect to the bracket 1742.

[00100] As shown, the outrigger assembly 1740 may further include a rotator actuator 1723 coupled to the rotator 1744. The rotator actuator 1723 may be configured to rotate the rotator 1744 relative to the bracket 1742 about the longitudinal axis of the shaft 1746. According to various embodiments, the rotator actuator 1723 may include a linear actuator. One end of the
5 rotator actuator 1723 may be pivotably mounted to a frame 1710. Another end of the rotator actuator 1723 may be pivotably coupled to the rotator 1744. The rotator actuator 1723 may be arranged such that a linear force from the rotator actuator 1723 may be transmitted as a tangential force acting on the rotator 1744 to rotate the rotator 1744 about the longitudinal axis of the shaft 1746. Accordingly, the rotator actuator 1723 may be configured to apply a linear
10 force tangent to a circumference of the rotator 1744 and which is perpendicular to the longitudinal axis of the shaft 1746. The rotator 1744 may include a mounting arm 1722 extending from the circumferential wall of the rotator 1744. The rotator actuator 1723 may be pivotably coupled to an end of the mounting arm 1722 such that a linear force from the rotator actuator 1723 may be transmitted as a turning force on the mounting arm 1722 to rotate the
15 rotator 1744.

[00101] According to various embodiments, the bracket 1742 may further include a hole 1724 for receiving a bolt to act as a protrusion. The shaft 1746 may further include a three-sectioned groove 1745. The three-sectioned groove 1745 may include a first groove section along the shaft 1746 in the longitudinal direction, a second groove section perpendicular to the
20 first groove section, and a third groove section along the shaft 1746 in the longitudinal direction. Accordingly, the three-sectioned groove 1745 may be a substantially Z-shape. In this arrangement, the bracket 1742 may be engaged with the shaft 1746 by having the protrusion of the bracket 1742 received in the three-sectioned groove of the shaft 1746. In this manner, the shaft 1746 may be partially extended as shown in FIG. 17B as the first groove section of the
25 shaft 1746 slide along the protrusion of the bracket 1742. As the second groove section reach the protrusion of the bracket 1742, the engagement may stop further extension of the shaft 1746. To further extend the shaft 1746, the rotator 1744 may be operated to rotate the shaft 1746 such that the second groove section of the shaft 1746 may slide through the protrusion of the bracket 1742. Upon completion of the rotation of the shaft 1746 by the rotator 1744, the shaft 1746
30 may be further extended as the shaft 1746 is moved such that the third groove section of the shaft 1746 slides through the protrusion of the bracket 1742. Accordingly, the three-sectioned groove 1745 may serve to provide a safety limit stop for the extension of the shaft 1746 and only allow full extension when the shaft 1746 is rotated.

[00102] As shown, the outrigger assembly 1740 may further include a shaft actuator 1760
35 coupled to the shaft 1746 and configured to translate the shaft 1746 along the longitudinal axis of the shaft 1746. Accordingly, the shaft actuator 1760 may apply a linear force in the

longitudinal direction of the shaft 1746 to slide, move, or translate the shaft 1746 along the longitudinal axis of the shaft 146 relative to the bracket 1742. According to various embodiments, the shaft actuator 1760 may be a pneumatic actuator. Accordingly, the shaft actuator 1760 may be linked up to a pneumatic suspension mechanism of the truck or the trailer
5 for powering the pneumatic actuator to actuate the shaft 1746.

[00103] As shown, the shaft 1746 may be hollow such that the shaft actuator 1760 may be received inside the shaft 1746 and coupled to an interior of the shaft 1746. In this configuration, when the shaft 1746 is retracted, the shaft actuator 1760 may be concealed inside the shaft 1746. As the shaft 1746 is being extended longitudinally, the shaft actuator 1760 may be exposed.
10 According to various embodiments, the shaft actuator 1760 and the shaft 1746 may be coupled such that the shaft 1746 may be rotatable relative to the shaft actuator 1760 about the longitudinal axis of the shaft 1746. Accordingly, the coupling between the shaft actuator 1760 and the shaft 1746 may not restrict the rotation of the shaft 1746 about the longitudinal axis of the shaft 1746 caused by the engagement between the first cooperative element of the bracket
15 1742 and the second cooperative element of the shaft 1746.

[00104] FIGs. 17A to 17C also illustrate a method of deploying the outrigger assembly 1740. As shown in FIG. 17A, the locking mechanism 1752 may be operated to unlock the shaft 1746 as indicated by arrow A. At the same time, the shaft actuator 1760 may be operated to extend the shaft 1746 longitudinally as indicated by arrow B. As shown in FIG. 17B, the rotator actuator 1723 may be operated to apply a turning force in the direction as indicated by arrow C
20 so as to rotate the shaft 1746 about the longitudinal axis of the shaft 1746, in the direction as indicated by arrow D. FIG. 17C shows that after the shaft 1746 is rotated, the rotator actuator 1723 may continue to apply a force in the direction as indicated by arrow C to maintain the shaft 1746 in the rotated orientation while the shaft actuator 1760 may continue to apply a linear force
25 along the longitudinal axis of the shaft 1746 in the direction as indicated by arrow B to continue to extend the shaft 1746. When the shaft 1746 is fully extended, the locking mechanism may be operated to lock the shaft 1746 as indicated by arrow A.

[00105] According to various embodiments, there may be provided a vehicle outrigger and landing gear apparatus for supporting a load and for detachably mounting to a truck or a trailer.
30 The apparatus may be adapted to be completely separable from a vehicle, i.e. a truck or a trailer or a heavy goods vehicle (HGV), it is intended to be supported on. The apparatus may include a goods supportable frame mountable to the vehicle such as a HGV; and a plurality of moveable outrigger arms fitted to the frame, each outrigger arm further including a landing leg fitted thereto, each outrigger arm being moveable from a stowed to a deployed position enabling the
35 frame to be supported on the landing legs in the deployed position; wherein movement of each

outrigger arm from its stowed to its deployed position involves both translation and rotation of the arm relative to the frame.

[00106] When such a piece of apparatus is carried or fitted to the HGV, the deployment of the apparatus (which can be relatively rapid and controlled) when it is carrying a load, such as a filled transport container, a detachable HGV body, or goods, means that the HGV can simply drive away from the load now supported on the deployed free-standing apparatus, to pick up another load laden apparatus.

[00107] Furthermore, when the apparatus is in its fully deployed position the legs are standing at a distance from a vehicle able to carry the apparatus which assist the driver of the vehicle to drive off relatively rapidly as the driver need not worry about hitting the legs if he does not drive off in a perfectly straight manner.

[00108] According to various embodiments, there may be provided a system to enable a heavy goods vehicle (HGV) to rapidly offload the goods it is carrying. The system may include a vehicle outrigger and landing gear apparatus adapted to support a load. The apparatus may include a goods supportable frame mountable the heavy goods vehicle (HGV); a plurality of moveable outrigger arms fitted to the frame, each outrigger arm further including a landing leg fitted thereto, each outrigger arm being moveable from a stowed to a deployed position enabling the frame to be supported on the landing legs in the deployed position; and wherein movement of each outrigger arm from its stowed to its deployed position involves both translation and rotation of the outrigger arm relative to the frame; and a HGV adapted to support the vehicle outrigger and landing gear apparatus.

[00109] Providing both the apparatus and the HGV together as part of a system means that the operator can operate the apparatus and this will enable a HGV to off-load its load carried on the vehicle outrigger and landing gear apparatus and subsequently drive off to pick up for example another load or a non-load supporting apparatus far more rapidly.

[00110] Preferably, one or more of the outrigger arms are pneumatically operable and the HGV includes means to connect the vehicle's pneumatic suspension system to the or each pneumatically operable outrigger arm of the vehicle outrigger and landing gear apparatus.

[00111] In either the apparatus or the system, preferably at least some of the pneumatically operable outrigger arms are independently operable from the rest. In such form, there are six pneumatically operable outrigger arms, of which two are independently operable from the other four.

[00112] In either the apparatus or the system, preferably, rotational and translational movement of each outrigger arm occurs simultaneously. In either the apparatus or the system, preferably, wherein each outrigger arm is surrounded by one or more fixed collars, the outrigger arm and one or more of its respective collars being provided with one or more pairs of

cooperating guide members adapted to cause the rotational movement of the outrigger arm when the outrigger arm moves relative to the collar from its stowed to its deployed position. In such form, the cooperating guide members are respective tongue and groove components.

5 [00113] In either the apparatus or the system, preferably, the, or each collar is a closed collar.

[00114] In either the apparatus or the system, preferably, the, or each collar is concentric with the outrigger arm.

10 [00115] In either the apparatus or the system, preferably, the or each collar is a polygonal tube. In such form, at least a portion of the outrigger arm is so sized and mutually polygonally shaped as to cooperatively engage with the polygonal tube. Such an arrangement will serve to trap the outrigger arm in a particular position when the polygonal tube overlies the polygonally shaped portion of the outrigger arm.

[00116] In either the apparatus or the system, preferably, the polygonal tube is a square tube.

15 [00117] In either the apparatus or the system, preferably, one or more locking bolts is/are provided to lock each of the outrigger arms in either their stowed or deployed position, the or each locking bolt being moveable between a locked and an unlocked position, wherein the or each locking bolt is located on the polygonal tube. Preferably, the, or each locking bolt is/are provided with biasing means adapted to bias the, or each locking bolt towards an engaged (or locking) position. With such an arrangement, as any form of load e.g. a filled (or empty) transport container supported on the frame of the deployed apparatus acts through the legs in a cantilever action in the vertical plane, the larger the number of locking bolts in the outrigger arms the better, as it helps to split the load (be it a filled transport container, detachable HGV body, or goods on flat beds without enclosing structure), between them. By contrast the load in the legs acts vertically through the leg which requires no locking bolts. Accordingly, although, 25 they could be extendible, in either the apparatus or the system, preferably, each landing leg is non-extendible.

30 [00118] As the legs are not extendible, it is particularly preferred if the apparatus is adapted to be pneumatically operable as then, the apparatus could, in principle be so arranged as to be connectable to the pneumatic suspension system of a HGV. This is advantageous as when the vehicle raises and lowers itself through its own pneumatics, the landing legs which themselves, do not possess any lifting capability on their own, (the pneumatic cylinders of the outrigger arms only used for deployment and retraction) are only required to support the frame during deployment. The vehicle simply continues to lower when the landing legs become ground contacting. In such form, the pneumatically actuable vehicle outrigger and landing gear 35 apparatus is actuated by a pair of control boxes.

[00119] Although several ways might be envisioned by which the HGV pneumatic suspension system could be connected to the pneumatic systems of the apparatus, in either the apparatus or the system, preferably the pair of control boxes are adapted to control both the locking bolts, and the pneumatically operable outrigger arms.

5 [00120] A typical pneumatic suspension of a HGV is meant to be able to lift up to 24 tons based on the vehicle type, and consequently they possess huge pneumatic air bags to be able to do that as part of the vehicle's pneumatic suspension system. With such an air bag, initially raising the fully laden HGV using the vehicle's own pneumatic suspension system and subsequently deploying the vehicle outrigger and leg apparatus using the same pneumatic
10 suspension system simply is more practical than designing a separate system.

[00121] The goods supportable frame mountable to a HGV could be mounted to a flat-bed (without enclosing structure or cargo pod) trailer of a HGV but preferably, it is mounted to the chassis of a HGV.

[00122] In either the apparatus or the system, preferably, the apparatus further includes
15 means to engage and disengage the frame from a chassis of a HGV. This has the advantage of enabling the frame to be securely engaged to the vehicle during transportation.

[00123] In either the apparatus or the system, preferably, each landing legs includes a counterbalancing mechanism.

[00124] According to various embodiments, there may be provided a HGV incorporating the
20 apparatus as specified hereinabove.

[00125] According to various embodiments, there may be provided a HGV incorporating the apparatus as specified hereinabove, carrying a filled transport container, detachable HGV body, or goods.

[00126] According to various embodiments, there may be provided a method of unloading a
25 HGV. The method may include providing a HGV containing a load, such as a filled transport container, detachable HGV body, or goods, on a leg containing goods supportable frame; raising the frame and separating it from the vehicle such that the frame legs in the raised state are ground contacting; and allowing the vehicle to move off leaving the goods to be unloaded from the frame.

30 [00127] Such a method may greatly decrease the turnaround time for vehicle operators as the rapid off-loading of the transported goods (enabling it to be unloaded at a different time) yet allowing the HGV operator to move off after off-loading is a far faster arrangement than waiting for the goods that have been transported, to be unloaded.

[00128] Preferably, the leg containing goods supportable frame is the apparatus as specified
35 herein.

[00129] Preferably, the method further includes the step of unlocking the goods supportable frame from the chassis.

[00130] Preferably, separation of the apparatus from the vehicle occurs when the outrigger arms are in their deployed position and as the vehicle lowers.

5 [00131] As it is envisioned that a raised unloading area (loading bay) may be present in the unloading area and the filled transport container, detachable HGV body, or goods are off-loaded adjacent this area, preferably, the frame remains in its deployed state during unloading and, if required subsequent reloading.

[00132] During recovery of the frame, a HGV positions it's chassis underneath the frame
10 which is standing on its legs. The vehicle then pneumatically raises itself on its pneumatic suspension such that the chassis contacts the underside of the frame lifting it slightly such that the legs are no longer in contact with the ground. (In the case where the HGV does not possess a pneumatic suspension system to raise the frame, the lifting force could be provided by a variety of existing lifting systems such as hydraulic or electric jack systems.) The frame is then secured
15 to the chassis and reconnected to the pneumatic system of the vehicle and the legs and outriggers (in the case of the present apparatus) are retracted and the vehicle then lowers back to its normal driving position height and the vehicle is now able to drive off.

[00133] FIGs. 18A and 18B show an apparatus 1800 for supporting a load and for detachably mounting to a vehicle, such as a truck or a trailer or a heavy goods vehicle (HGV).
20 The apparatus 1800 may be adapted to be completely separable from the truck or the trailer or the heavy goods vehicle (HGV) to which it is intended to be carried on, and operatively connected to. In addition, the apparatus 1800 may allow loads or goods, carried by the truck or the trailer or the HGV, and mounted on top of the goods supportable rectangular frame 1810 to freely stand on the apparatus 1800 when the apparatus 1800 is in its fully deployed position.

25 [00134] The frame 1810 may be mounted to four horizontal, elongate, telescopically extendible outrigger arms 1881, the arms 1881 being adapted to be moveable from a stowed to a deployed position. A landing gear including a vertical elongate telescopically extendible ground contactable leg 1880 may be operatively connected to the deployable (or distal) end of each of the outrigger arms 1881, which may also be moveable between a stowed and a deployed
30 position to support the frame 1810 above the ground in the deployed position. The apparatus 1800 may also contain in this embodiment, a pair of locking pins 1896 per arm 1881 and a single locking pin 1886 per leg 1880.

[00135] Each of the locking pins 1886, 1896 may be adapted to be moveable (FIGs. 29A to 29D) between a locked and an unlocked position so as to lock each of the arms 1881 or the legs
35 1880 in either their stowed or deployed position.

[00136] The arrangement of the aforementioned component parts of the apparatus 1800 may be such that when the apparatus 1800 in its fully deployed position, on account of both the horizontal and vertical telescopic extension, the entire apparatus 1800 may be located at a distance from a vehicle able to carry the apparatus 1800.

5 [00137] FIG. 20 shows a perspective view 2001 of the arm 1881 and the leg 1880 according to various embodiments. FIGs. 22A and 22B show a front view 2201 and a side view 2203 of the arm 1881 and the leg 1880 according to various embodiments. FIG. 23 shows a front view 2301 and a side view 2303 of an outer housing sleeve 1892 of the arm 1881 according to various embodiments. FIG. 24 shows a front view 2401 and a side view 2403 of an inner telescoping
10 outrigger sleeve 1894 of the arm 1881 according to various embodiments. FIG. 25 shows a front view 2501 and a side view 2503 of an outer housing sleeve 1882 of the leg 1880 according to various embodiments. FIG. 26 shows a front view 2601 and a side view 2603 of an inner telescoping landing sleeve leg 1884 according to various embodiments.

[00138] As shown, each arm 1881 may include a square outer housing sleeve 1892 which, at
15 its proximal end houses one end of an outrigger pneumatic deployment piston and return cylinder 1898, together with a safety spring 1891. Four square holes 1893 may be present, two in each opposing side of the housing 1892 to accommodate a pair of slidable locking pin 1896. In addition each arm 1881 may include an inner telescoping outrigger sleeve 1894 concentric with the outer sleeve 1892, including roller bearings 1897 which may reduce friction on inner
20 sleeve 1894 as it moves from its stowed to its deployed position.

[00139] Similar holes 1895 may be located on the inner sleeve 1894 which may overlie with the holes 1893 of the outer sleeve 1892 when the inner sleeve 1894 moves relative to the outer one 1892. Inner sleeve 1894, towards its distal end, may be provided with an internally fitted downwardly depending mounting plate 1899 in its intended attitude of operation which acts as a
25 securing point for the other end of the outrigger pneumatic deployment piston and return cylinder 1898. The distal end of the inner sleeve 1894 may be covered with a plate 1889 which may act as a mounting plate and bolt holes for the proximal end of the outer housing sleeve 1882 of a leg 1880.

[00140] In a similar manner to the arm 1881, each leg 1880 may include a square outer
30 housing sleeve 1882 that is a hollow square tube which, at its proximal end houses one end of another outrigger pneumatic deployment piston and return cylinder 1886. Two square holes 1883 may be present in each opposing side of the outer housing 1882 to accommodate a slidable locking pin 1886. In addition each leg 1880 may include an inner telescoping landing sleeve leg 1884. The inner sleeve 1884 may possess an internally fitted horizontally projecting mounting
35 plate 1887 in its intended attitude of operation, which may act as a securing point for the other end of the outrigger pneumatic deployment piston and return cylinder 1886. Similar holes 1885

may be located on the inner sleeve 1884 which may overlies with the holes 1883 of the outer sleeve 30 when the inner sleeve 1884 moves relative to the outer one 1882.

[00141] The distal end of the inner leg 1884, may be provided with a rubber foot 1828 and grab handles 1829 in the form of a square hollow tube which slides inside the outer housing 1882 of the leg 1880. The grab handles 1829 may be provided in case an operator wants to actuate a leg 1880 in a manual override mode without the aid of pneumatics.

[00142] FIG. 21 shows a front view 2101, a side view 2103 and a plan view 2103 of the locking pin 1886, 1896 with actuator according to various embodiments. FIG. 19 shows a front view 1901 and a side view 1903 of the locking pin 1886, 1896 according to various embodiments. FIGs. 29A to 29D show a method 2901 of operating the locking mechanism of the locking pin 1886, 1898 according to various embodiments. As shown, each locking pin 1886, 1896 may be maintained within a housing 1832 and may be pneumatically operable and may include a pneumatic cylinder 1836 attached to a square cross-sectioned lock pin body 1834 of high strength non-corrosive steel which may be so dimensioned as to provide a complementary sliding-fit arrangement with apertures 1883, 1893. The body 1832 may possess a pair of 5mm wide by 5mm deep milled elongate square slots 1838 designed to accommodate mutually cooperating end portions 1839 of the inner telescoping outrigger sleeve 1894 to form a tongue and groove arrangement when locked together.

[00143] The end portions 1839 may be urged into milled slots 1838 by the bias spring 1837 and as a result of the spring 1837 which is integral to the locking pin pneumatic piston, positive pressure has to be applied to the inner telescoping outrigger sleeve 1894 to ensure its full retraction. This arrangement may provide a dead-lock when the inner telescoping outrigger sleeve 1894 comes to rest when the pneumatic air source is turned off. An identical tongue and groove arrangement may be provided for the leg 1880. In the latter case however, no safety spring 1837 may be required, as the tongue may be urged into the groove through the action of gravity.

[00144] In case of a pneumatic failure of the arms 1881 or legs 1880, they can be manually overridden by lifting the grab handles 1829 to disengage the dead-locking provided by the tongue and groove and similarly the arm 1881 may be pushed inwardly towards the frame 1810 to push against the bias of spring 1890 to similarly disengage the tongue and groove dead-locking. An additional bias spring 1837 may be provided in the pneumatic sleeve 1836 of the locking pin 1886, 1896 to bias the locking pin 1886, 1896 towards the locked position, thus ensuring that in the unlikely event of the locking pin 1886, 1896 becoming disengaged from the dead-lock and slipping out, the locking pin 1886, 1896 may be unable to fully slide out of the apertures 1883, 1893 as the spring 1837 may always bias the locking pin 1886, 1896 towards

and thus retain it within the apertures 1883, 1893. This feature may be considered to be double redundancy but is an additional safety feature of the apparatus and system.

[00145] The locking pins 1886, 1896 themselves may be the main load bearers both along the vertical plane (for the landing gear legs 1880) and horizontal (outrigger arms 1881) plane and in the illustrated embodiment, three locking pin assemblies may be required for each combined arm 1881 and leg 1880.

[00146] Similarly the locking pin 1886, 1896 may be provided with a manual override in the form of a spigot 1835. Freely sliding along the locking pin shaft is the safety spring 1837 which may require positive pressure provided pneumatically or manually. By pulling the spigot 1835, the locking pin 1886, 1896 may be manually disengaged from the arm 1881 or leg 1880. Manually sliding the locking pin towards the open position would compress the safety spring 1837 but would allow for manual disengagement of the locking pin 1886, 1896.

[00147] In this embodiment containing two locking pins 1896 in the arm 1881, the proximal (inner) locking pin may not have the safety spring 1837, only the outer one does. This is because it may be quite impossible for a single operator to manually override two locking pins 1837 in the same arm 1881 to move the inner telescoping outrigger sleeve 1894 inwards in the event of a pneumatic failure.

[00148] Accordingly, only one locking pin 1896 per arm 1881 may be provided with a safety spring 1837. The leg 1880 in this particular embodiment may always contain a locking pin 1886 with a safety spring 1837 as there is only one locking pin 1886 per leg 1880.

[00149] FIG. 28 shows a front view 2801 and a plan view 2803 of a control box 1870 of the apparatus 1800. The control box 1870 may also be provided (intended to be located away from moving parts for safety reasons) on the frame 1810 which serves as a means of:

a) conveniently linking the pneumatic system of the HGV to the pneumatic systems 1836, 1888, 1898 of the apparatus 1800;

b) arranging the hoses 1877 required in an ordered manner; and

c) actuation for the combined apparatus and HGV system which may enable the HGV to rapidly off-load the goods it is carrying;

including a pair of mechanical valves 1871, 1872:

- i) the first valve 1871, for the simultaneous control, activation and return of all of the locking pin 1886, 1896 pneumatic cylinders 1836; and
- ii) the second valve 1872, for the simultaneous control, activation and return of all of the outrigger arms 1881 and legs 1880.F

[00150] Essentially a disconnectable 10mm hose 1874 connected to the HGVs pneumatic system enters control box 1870 and a bundle of hoses 1875 exit the control box 1870. The hoses 1877 employed throughout are colour coded to aid identification if there is a problem. In

addition, a master switch 1873 may be provided to turn on / shut-off the air supply prior to the HGV moving between locations. It may also be preferable to only have the master switch in the on position only when operating the apparatus 1800. Air divider units 1876 may also be supplied to split the pneumatic air from the valves into four to six outlets depending on the number of outrigger legs in the system.

[00151] FIGs. 27A to 27I illustrate the apparatus 1800 described above mounted to and operatively connected to a truck 2704 to form a system which acts together. The system illustrated include the truck 2704, such as an empty truck chassis and cab or chassis unit, fitted with the apparatus 1800 and a carrying a load 2702 mounted to the apparatus 1800. When fully deployed, the apparatus 1800 may enable the chassis unit to drive away while the load 2702 and the apparatus 1800 remain standing on the legs 1880 of the apparatus 1800.

[00152] The system may be primarily employed where it is desirable to allow the load 2702 to be unloaded or an empty transport container, detachable HGV body, flat bed or curtain sided container to be filled at a raised loading bay platform while it is standing directly on the deployed apparatus 1800. The detached chassis unit can then be driven to pick up more goods, (or an empty transport container, detachable HGV body, flat bed or curtain sided container) which is ready for delivery. This type of system may allow an increase in efficiency of the truck 2704 use and lower overall costs.

[00153] A method 2701 of operating the system is also shown in FIGs. 27A to 27I and is summarised in the following.

[00154] Deployment operation according to various embodiments is described in the following with reference to FIGs. 27A to 27E.

[00155] The truck 2704 may come to a complete stop on flat ground – typically backed up to a loading bay as shown in FIG. 27A. While the load 2702 is still resting firmly on the frame 1810 of the apparatus 1800 detachably mounted to the chassis 2711 of the truck 2704, the securing devices or lock that secures the frame 1810 to the chassis 2711 may be disengaged. The truck 2704 may then be raised on its pneumatic suspension system to its highest possible level (or a height determined by the operator depending on conditions) and locked in place as shown in FIG. 27B, with the engine still running. The running of the engine may provide compressed air for operation of the pneumatic system.

[00156] The operator may first ensure that the master switch 1873 is in the “ON” position and supplies compressed air to the pneumatic system to the apparatus 1800. The operator may then push and hold down the valve actuator 1872 to fully retract the inner arm 1894 so that the dead-lock is released. Whilst maintaining the actuation of valve actuator 1872, valve actuator 1871 may be pushed and held down, which causes the locking pins 1886, 1896 to disengage and move from their locked to their unlocked position.

[00157] The operator may then release valve actuator 1872 which may cause the inner telescoping outrigger arm 1894 and the inner telescoping landing sleeve leg 1884 to extend respectively to their fully extended position. The operator then releases valve actuator 1871 causing the locking pins 1886, 1896 to move from their unlocked to their locked position, preventing the inner arms 1894 and inner legs 1884 from retracting.

[00158] The operator may then rotate the master switch 1873 to its "OFF" position and then disconnects the 10mm hose 1874 from the control box 1870. The operator may finally pneumatically lower the suspension of the chassis 2711 of the truck 2704 to its lowest point (as shown in FIG. 27C) and may then able to safely drive the chassis away (as shown in FIG. 27D) now that the load 2702 are free standing (as shown in FIG. 27E) on the apparatus 1800.

[00159] Stowing operation according to various embodiments is described in the following with reference to FIGs. 27F to 27I.

[00160] The operator may pneumatically lower the chassis 2711 of the truck 2704 to its lowest position, and positions the chassis directly below the apparatus 1800 supporting either the load 2702, such as goods, or an empty transport container, detachable HGV body, flat bed or curtain sided container, and aligned correctly as shown in FIG. 27F.

[00161] Subsequently, the operator may pneumatically raises the chassis 2711 of the truck 2704 to its highest position (as shown in FIG. 27G) by which point, the feet 1828 of the legs 1880 are no longer in contact with the ground, and secures the chassis 2711 to the frame 1810 of the apparatus 1800 by means of the locking system and reconnects the 10mm hose 1874 to the control box 1870, followed by turning the master switch 1873 into the "ON" position.

[00162] Once the legs 1880 are no longer in contact with the ground, and air is supplied to the system, the locking pins 1886, 1896 may be able to disengage normally. The operator may then press and hold down valve actuator 1871, which may cause the locking pins 1886, 1896 to disengage and move from their locked to their unlocked positions. Whilst maintaining the actuation of valve actuator 1871, valve actuator 1872 may be pushed and held down to fully retract the inner arm 1894 and raise the inner telescoping landing sleeve leg 1884. Continuing to maintain pressure on the valve actuator 1872, may cause the inner telescoping outrigger arm 1894 and the inner telescoping landing sleeve leg 1884 to retract respectively to their stowed position.

[00163] The operator may then release valve actuator 1871 causing the locking pins 1886, 1896 to move from their unlocked to their locked position, preventing the inner arms 1894 and inner legs 1884 from deploying.

[00164] The operator may then release valve actuator 1872 which may causes the inner arm 1894, and the inner telescoping landing sleeve leg 1884 to form a dead-lock with the locking pin 1886, 1896. The operator may then rotate the master switch 1873 to its "OFF" position. The

operator is then in a position to secure or lock the frame 1810 to the chassis 2711 (as shown in FIG. 27H) and lower the chassis 2711 to the normal driving position, before driving away (as shown in FIG. 27I).

[00165] The system may be operated by a single person and (excluding chassis raising and lowering) may have a cycle time of less than 30 seconds which greatly reduces the turn-around time for both loading and unloading an HGV and may be used with the chassis of a single (rigid) HGV or the chassis of an articulated HGV. The system may so be adapted to be able to carry a static load of 10 tons per leg, which when combined typically exceeds the maximum cargo weight of a HGV by at least three times. A manual override system may be in place and deployment possible in case the pneumatic system fails.

[00166] In alternative non-illustrated embodiments the number of arms and legs of the apparatus may increase typically from four to six. If the number of locking pins 1886, 1896 increases in the legs 1880, only one of the locking pins 1886, 1896 in the leg 1880 may contain the safety spring 1836 for the same reasons as explained with the arm 1881 herein above.

[00167] According to various embodiments, there may be provided a vehicle outrigger and landing gear apparatus for supporting a load and for detachably mounting to a truck or a trailer. The apparatus may be adapted to be completely separable from a vehicle it is intended to be supported on. The apparatus may include a goods supportable frame mountable to a heavy goods vehicle (HGV); a plurality of moveable outrigger arms fitted to the frame each moveable between a stowed and a deployed position; a landing gear including a ground contactable leg operatively connected to each outrigger arm and moveable between a stowed and a deployed position to support the frame above the ground in the deployed position; and a plurality of locking pins each moveable between a locked and an unlocked position so as to lock each of the arms and legs in either their stowed or deployed position; their arrangement being such that when the apparatus in its fully deployed position, the entire apparatus is located at a distance from a vehicle able to carry/support the apparatus, when the arms and legs are in their stowed position.

[00168] When such a piece of apparatus is carried or fitted to a HGV, the deployment of the apparatus (which can be relatively rapid) when it is carrying goods, means that the HGV can simply drive away from the transport container or goods now supported on the deployed freestanding apparatus, to pick up another container or goods laden apparatus. At the same time, when the apparatus is in its deployed position and supporting the weight of the goods, it is locked into place by the locking pins providing added safety. In fact, the locking pins are so designed (see later) as to ensure that the arms and legs are dead-locked into place when either are in their respective stowed or deployed positions.

[00169] Alternatively, the vehicle can go on to drive and stop under a similarly deployed apparatus supporting either an *empty* transport container or nothing at all, which can then be rapidly collapsed back into its stowed position and onto the HGV, enabling the vehicle to be directly loaded with goods.

5 [00170] The goods supportable frame mountable to a HGV could be mounted to a flat-bed (without enclosing structure) trailer of a HGV but preferably, it is mounted to the chassis of a HGV.

[00171] Preferably, the apparatus further includes means to engage and disengage the frame from a chassis of a HGV. This has the advantage of enabling the frame to be securely engaged
10 to the vehicle during transportation.

[00172] Preferably, the locking pins are at least substantially quadrilateral in cross-section throughout their length. Although angled pins would be harder to fabricate than round ones, such a flat or angled cross-section is more beneficial as the main weight bearer along both horizontal and vertical axes are on the pins. Flat as opposed to round or elliptical surface areas
15 have a larger surface area and would distribute the weight better. In such form, a groove or notch added to the pins allows for a better locking mechanism.

[00173] Preferably, the arms are provided with biasing means adapted to provide a bias towards the deployed position of the arm.

[00174] Such an arrangement could assist in dead-locking the locking pin when each arm is
20 in its locked or in its stowed position.

[00175] At least one locking pin and at least one of an arm and a leg are provided with mutually cooperating tongue and groove portions to provide dead-locking of the locking pin. In the stowed position, such an arrangement together with the bias, means that the locking pin cannot accidentally unlock (and move from the locked position to the unlocked position) and
25 can only unlock with the application of either a pneumatic air source or manual pressure. When using manual pressure, initially to a leg a crow bar could be slid into an aperture in the leg and lifting the leg or the leg could be supplied with grab handles. This lifting unlocks the dead-lock allowing the locking pin to be moved. Once the leg is no longer ground engaging, the arm can be similarly slid towards the stowed position to unlock the dead-locking caused by the tongue
30 and groove. In such form, the biasing means is a spring.

[00176] The arms and legs could in principle move from a stowed position to a deployed position through a scissor action, however, preferably, the arms and legs are adapted to telescopically extend when they move from their stowed to their deployed position.

[00177] Preferably, a plurality of locking pins are employed in an arm. With such an
35 arrangement, as any form of load e.g. a filled (or empty) transport container supported on the frame of the deployed apparatus acts through the legs in a cantilever action in the vertical plane,

the larger the number of locking pins in the arms the better as it helps to split the load, between them. By contrast the load in the legs acts vertically through the leg and can easily be borne by the single pin in the orthogonal plane. Typically therefore, more locking pins are used in the arms than the legs.

5 [00178] Although the arms and legs and even the locking pins of the apparatus could be manually or hydraulically operated, it is particularly preferred if the apparatus is adapted to be pneumatically operable as then, the apparatus could, in principle be so arranged as to be connectable to the pneumatic system of a HGV.

[00179] This is a requirement as the vehicle raises and lowers itself whereas the legs
10 themselves do not possess any lifting capability on their own, with their pneumatic cylinders only used for deployment and retraction.

[00180] The legs receive the pneumatic pressure from the vehicle because the cylinders in the legs are unlikely to possess sufficient lifting capability to lift either an empty or fully laden transport container on their own because their design specification only requires the capacity to
15 deploy the legs. In such form, the combined designed lifting capability of all of the pneumatically operable legs is likely to be about 150kg or less.

[00181] By comparison, a typical pneumatic suspension of a HGV is meant to be able to lift up to 24 tons based on the vehicle type, and consequently they possess huge pneumatic air bags to be able to do that as part of the vehicle's pneumatic suspension system. With such an air bag,
20 initially raising the fully laden HGV using the vehicle's own pneumatic system and subsequently deploying the vehicle outrigger and landing gear apparatus using the same pneumatic system simply makes more sense than designing a separate system.

[00182] According to various embodiments, there may be provided a HGV incorporating the apparatus as specified hereinabove.

25 [00183] According to various embodiments, there may be provided a HGV incorporating the apparatus as specified hereinabove, carrying goods or an empty transport container, detachable HGV body, flat bed or curtain sided container.

[00184] According to various embodiments, there may be provided a system to enable a HGV to rapidly offload the goods it is carrying. The system may include a vehicle outrigger and
30 landing gear apparatus adapted to support a load the apparatus including a goods supportable frame mountable to a HGV, preferably its chassis; a plurality of pneumatically moveable outrigger arms fitted to the frame each moveable between a stowed and a deployed position; a landing gear including a ground contactable leg operatively connected to each outrigger arm and pneumatically moveable between a stowed and a deployed position to support the frame above
35 the ground in the deployed position; and a plurality of locking pins each moveable between a locked and an unlocked position so as to lock each of the arms and legs in their stowed or

deployed position; and a HGV including means to connect the vehicle's pneumatic system to the pneumatically operable arms and legs of the vehicle outrigger and landing gear apparatus.

[00185] Providing both the apparatus and the HGV together, as part of a system, means that the HGV can operate the apparatus and this will enable a HGV to off-load the goods carried on the vehicle outrigger and landing gear apparatus and subsequently drive off to pick up for example more goods carried on a vehicle outrigger and landing gear apparatus, or a nongoods supporting vehicle outrigger and landing gear apparatus far more rapidly.

[00186] Although several ways might be envisioned by which the HGV pneumatic system could be connected to the pneumatic systems of the apparatus, preferably the system further includes a control box provided with actuation means to control the locking pins, and the pneumatically operable arms and legs.

[00187] To prevent accidental disengagement of a locking spring, preferably, a locking pin is provided with biasing means adapted to bias the locking pin towards an engaged (or locking) position. In such form the biasing means is a spring.

[00188] However, preferably, such a biasing means will only be present once in an arm containing multiple locking pins. This is because it would be quite impossible for a single operator to manually override two locking pins in the same arm to move the arm inwards in the event of a pneumatic failure.

[00189] Preferably, the system further includes means to engage and disengage the frame from the chassis.

[00190] Preferably, the arms are provided with biasing means adapted to provide a bias towards the deployed position. In such form the bias is a spring.

[00191] Preferably, the arms and legs are adapted to telescopically extend when they move from their stowed to their deployed position. Telescopic extension enables the use of a pneumatic piston to be employed to assist with the telescoping.

[00192] Preferably, two locking pins are used for each arm.

[00193] According to various embodiments, there may be provided a method of off-loading a HGV. The method includes providing a HGV containing goods on a leg containing goods supportable frame; raising the frame to enable the legs to deploy and separating the leg containing, goods supportable frame from the vehicle, when the frame legs become ground contacting; and allowing the vehicle to move off leaving the goods to be unloaded from the frame.

[00194] Preferably, the leg containing goods supportable frame is the apparatus as specified herein.

[00195] Although the apparatus could be maintained in place on the chassis by a series of downwardly depending tangs, it would be preferable if the method further includes the step of unlocking the goods supportable frame from the chassis.

5 [00196] Providing a lockable system has the advantage that the apparatus could not accidentally separate from the chassis if the vehicle ended up on its side through for example a collision, thus minimising potential collateral damage.

[00197] Preferably, raising the frame occurs when the pneumatic suspension of the vehicle is operated and the legs are fully extended and locked into position prior to becoming ground contacting.

10 [00198] Preferably, separation occurs as the vehicle lowers.

[00199] Such a method would greatly decrease the turnaround time for vehicle operators as the rapid off-loading of the transported goods (enabling it to be unloaded at a different time) yet allowing the HGV operator to move off after off-loading is a far faster arrangement than waiting for the goods that have been transported, to be unloaded.

15 [00200] As it is envisioned that a raised unloading area (loading bay) will be present in the unloading area and the goods are off-loaded adjacent this area, preferably, the frame remains in its raised state by being supported on its deployed legs during unloading and, if required subsequent reloading.

[00201] During recovery of the frame, a HGV positions its chassis underneath the frame
20 which is standing on its legs. The vehicle then pneumatically raises itself on its pneumatic suspension such that the chassis contacts the underside of the frame lifting it slightly such that the legs are no longer in contact with the ground.

[00202] The frame is then secured to the chassis and reconnected to the pneumatic system of the vehicle and the legs and outriggers (in the case of the present apparatus) are retracted and the
25 vehicle then lowers back to its normal driving position height and the vehicle is now able to drive off.

[00203] FIG. 30A shows an exploded view of a locking mechanism 3000 for the various
outrigger assembly of the various apparatus 100, 400, 700, 1000, 1800 according to the various
embodiments. The locking mechanism may include an actuator 3010 such as a pneumatic
30 cylinder, a retaining piece 3020, a slider member 3030, a guide member 3040, a lock pin 3050, a
lock pin shaft 3060 and a base plate 3070.

[00204] FIG. 30B shows an assembled view of the locking mechanism 3000. As shown the
actuator 3010 may be coupled to the base plate 3070. For example, the actuator 3010 may be
bolted to the base plate 3070. Further, the actuator 3010 may include a rod 3012 drivable or
35 movable linearly in the longitudinal direction. An end of the rod 3012 may be coupled to the

slider member 3030 such that the actuator 3010 may actuate or drive the slider member 3030 to slide or translate along a surface 3072 of the base plate 3070.

[00205] The slider member 3030 may include an elongated slider slot 3032. The elongated slider slot 3032 may be inclined at an angle with respect to the surface 3072 of the base plate 3070 on which the slider member 3030 may slide.

[00206] The guide member 3040 may include an elongated guide slot 3042. The guide member 3040 may be coupled to the base plate 3070 such that the elongated guide slot 3042 may be perpendicular to the surface 3072 of the base plate 3070.

[00207] The slider member 3030 and the guide member 3040 may be arranged such that the angled elongated slider slot 3032 may line up with the vertical elongated guide slot 3042.

[00208] The lock pin 3050 may include an engagement element in the form of a protruding element extending sideways from the lock pin 3050 or in the form of the lock pin shaft 3060 inserted perpendicular through the lock pin 3050. Accordingly, the protruding element or the lock pin shaft 3060 may be at least substantially perpendicular to a longitudinal axis of the lock pin 3050. According to various embodiments, the engagement element may be configured to engage with both the elongated guide slot 3042 and the elongated slider slot 3032. As shown, the lock pin 3050 may be received in the guide member 3040, and the guide member 3040 may be received within the slider member 3030. Further, the lock pin 3050, the guide member 3040 and the slider member 3030 may be arranged such that the engagement element of the lock pin 3050 may be engaged to the elongated guide slot 3042 with the elongated guide slot 3042 parallel to a longitudinal axis of the lock pin 3050, and the engagement element of the lock pin 3050 may be engaged to the elongated slider slot 3032 with the elongated slider slot 3032 at an angle with respect to the longitudinal axis of the lock pin 3050.

[00209] In this arrangement, as the slider member 3030 moves relative to the guide member 3040, i.e. forward and backward, the engagement element may only move up and down the vertical elongated guide slot 3032 causing the lock pin 3050 to move into and out of the surface 3072 of the base plate 3070. Accordingly, the lock pin 3050 may rise or descend relative to the surface 3072 of the base plate 3070, i.e. move perpendicularly to the surface 3072 of the base plate 3070 along the longitudinal axis of the lock pin 3050. Since the guide member 3040 is fixed with respect to the base plate 3070, as the slider member 3030 slides with respect to the surface 3072 of the base plate 3070, the interaction between the angled elongated slider slot 3032 and the engagement element 3052 may cause the engagement element to move along the vertical elongated guide slot 3042 which is perpendicular to the surface of the base plate 3070. Accordingly, the locking mechanism 3000 may convert a linear motion of the actuator 3010 in a direction parallel to the surface 3072 of the base plate 3070 into a linear motion of the lock pin

3050 in a direction perpendicular to the surface 3072 of the base plate 3070. FIGs. 30C and 30D further illustrates the motion of the lock pin 3050.

[00210] The guide member 3040 may include two protruding guide structures 3044 which are aligned with the elongated guide slots 3042. The guide member 3040 may also include a collar portion 3046 for inserting into the base plate 3070. The collar portion 3046 may provide strong support for the lock pin 3050 which may have to withstand a shearing force. The lock pin 3050 may also have an increased width with rounded corners to prevent metal fatigue due to compressive and shearing stresses.

[00211] Advantageously, the locking mechanism 3000 may lie flat against the side of the various outrigger assemblies of the various apparatus 100, 400, 700, 1000, 1800 and therefore has a lower risk of damage. Further, the locking mechanism 3000 may be operated in a pair when used with the various outrigger assemblies. FIG. 31 shows an example of a pair of locking mechanism 3000 used with a vertically extendible outrigger assembly 3100. As shown, a pair of locking mechanism 3000 may be placed on opposite side of the outrigger assembly 3100. In this configuration, the pair of locking mechanism 3000 may withstand a total of 30 tons of vertical weight per outrigger assembly.

[00212] While the invention has been particularly shown and described with reference to specific embodiments, it should be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the scope of the invention as defined by the appended claims. The scope of the invention is thus indicated by the appended claims and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced.

Claims

1. An apparatus for supporting a load and for detachably mounting to a truck or a trailer,
5 the apparatus comprising:
a frame configured to support the load and configured to be detachably mounted to the truck or the trailer; and
an outrigger assembly mounted to the frame,
wherein the outrigger assembly comprises
10 a bracket mounted to the frame, the bracket having a protrusion,
a shaft movably received in the bracket, the shaft having a groove on a cylindrical surface of the shaft, and
a leg member coupled to an end of the shaft, the leg member being at least substantially perpendicular to the shaft,
15 wherein the protrusion of the bracket is received in the groove of the shaft, and
wherein the protrusion of the bracket and the groove of the shaft are engaged with each other and configured to be operable to rotate the shaft relative to the bracket about a longitudinal axis of the shaft.
- 20 2. The apparatus as claimed in claim 1, wherein the protrusion of the bracket and the groove of the shaft are configured to be operable to rotate the shaft relative to the bracket about a longitudinal axis of the shaft as the shaft translates along the longitudinal axis of the shaft.
3. The apparatus as claimed in claim 1 or 2, wherein a portion of the groove of the shaft
25 forms a helical groove on the cylindrical surface of the shaft.
4. The apparatus as claimed in claim 3, wherein the helical groove is configured to rotate the shaft at least substantially 90 degrees about the longitudinal axis of the shaft as the shaft translates along the longitudinal axis of the shaft.
- 30 5. The apparatus as claimed in claim 1, wherein the bracket comprises a rotator having the protrusion, the rotator coupled to the bracket and rotatable relative to the bracket about the longitudinal axis of the shaft, and the groove of the shaft comprises a linear groove lengthwise on a cylindrical surface of the shaft, and wherein the protrusion of the rotator is received in the
35 linear groove.

6. The apparatus as claimed in claim 5, wherein the outrigger assembly further comprises a rotator actuator coupled to the rotator and configured to rotate the rotator relative to the bracket about the longitudinal axis of the shaft.

5 7. The apparatus as claimed in claim 5 or 6, wherein the bracket further comprises a further protrusion and the shaft further comprises another groove in the form of a three-sectioned groove, the three-sectioned groove comprises a first groove section lengthwise along the shaft, a second groove section perpendicular to the first groove section, and a third groove section lengthwise along the shaft, and wherein the further protrusion of the bracket is received
10 in the three-sectioned groove.

8. The apparatus as claimed in any one of claims 1 to 7, wherein the outrigger assembly further comprises a shaft actuator coupled to the shaft and configured to translate the shaft along the longitudinal axis of the shaft.

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9. The apparatus as claimed in claim 8, wherein the shaft actuator comprises a pneumatic actuator.

10. The apparatus as claimed in any one of claims 1 to 9, wherein the shaft comprises a section with polygonal cross-section.

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11. The apparatus as claimed in claim 10, wherein the bracket comprises a cavity with a corresponding polygonal cross-section.

25 12. The apparatus as claimed in any of claims 1 to 11, wherein the outrigger assembly further comprises a shaft locking mechanism configured to lock the shaft to the bracket.

13. The apparatus as claimed in any one of claims 1 to 12, wherein the outrigger assembly further comprises a counterweight attached to an end of the leg member.

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14. The apparatus as claimed any one of claims 1 to 13, further comprising a control box mounted to the frame.

15. The apparatus as claimed in claim 14, wherein the control box comprises a connector
35 configured to connect the control box to an external pneumatic system.

16. The apparatus as claimed in claim 14 or 15, wherein the control box is configured to be operable to control a translation of the shaft along the longitudinal axis of the shaft.

17. The apparatus as claimed in any one of claims 1 to 16, wherein the frame comprises an alignment element configured to cooperate with a corresponding alignment component of the truck or the trailer to align the frame to the truck or the trailer for mounting the apparatus to the truck or the trailer.

18. The apparatus as claimed in any one of claims 1 to 17, wherein the frame comprises a locking block configured to cooperate with a corresponding locking block of the truck or the trailer for locking the frame to the truck or the trailer.

19. The apparatus as claimed in any one of claims 1 to 18, wherein the frame comprises coupling elements to couple the load to the frame.

20. The apparatus as claimed in claim 19, wherein the coupling elements comprises ISO container couplings.

21. The apparatus as claimed in claim 19 or 20, wherein the load comprises an ISO container, an ISO tank or cargo with ISO container frames.

22. The apparatus as claimed in any one of claims 1 to 21, further comprising a tailgate lift assist attached to the frame.

23. The apparatus as claimed in any one of claims 1 to 22, further comprising a visual alignment guide.

24. The apparatus as claimed in any one of claims 1 to 23, further comprising a further outrigger assembly mounted to the frame, wherein the further outrigger assembly comprises
a leg housing coupled to the frame,
an inner leg member slidably received inside the leg housing, the inner leg member slidable relative to the leg housing in a telescopic manner, and
a leg locking mechanism configured to lock the inner leg member to the leg housing.

25. The apparatus as claimed in claim 24, wherein the further outrigger assembly comprises a leg actuator coupled to the inner leg member.

26. The apparatus as claimed in claim 24 or 25, wherein the further outrigger assembly
5 comprises a leg biasing element coupled to the leg housing, the leg biasing element configured to provide a biasing force against the inner leg member in a leg retracted position.

27. The apparatus as claimed in any one of claims 24 to 26, wherein the further outrigger assembly comprises
10 an arm housing mounted to the frame,
an inner arm member slidably received inside the arm housing, the inner arm member slidable relative to the arm housing in a telescopic manner, wherein the leg housing is coupled to an end of the inner arm member and the leg housing is at least substantially perpendicular to the inner arm, and
15 an arm locking mechanism configured to lock the inner arm member to the arm housing.

28. The apparatus as claimed in claim 27, wherein the further outrigger assembly comprises an arm biasing element coupled to the arm housing, the arm biasing element configured to
20 provide a biasing force against the inner arm member in an arm retracted position.

29. The apparatus as claimed in claim 12, wherein the shaft locking mechanism comprises a locking pin and a pin biasing element configured to provide a biasing force against the locking pin in a pin retracted position.
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30. The apparatus as claimed in claim 24, wherein the leg locking mechanism comprises a locking pin and a pin biasing element configured to provide a biasing force against the locking pin in a pin retracted position.

30 31. The apparatus as claimed in claim 27, wherein the arm locking mechanism comprises a locking pin and comprises a pin biasing element configured to provide a biasing force against the locking pin in a pin retracted position.

32. The apparatus as claimed in claim 29, wherein the shaft locking mechanism, further
35 comprises

a guide member with an elongated guide slot; and

a slider member with an elongated slider slot,
wherein the locking pin comprises an engagement element configured to engage
with the elongated guide slot and the elongated slider slot,
wherein the locking pin is engaged to the elongated guide slot with the
5 elongated guide slot parallel to a longitudinal axis of the locking pin,
wherein the locking pin is engaged to the elongated slider slot with the
elongated slider slot at an angle with respect to the longitudinal axis of the locking pin, and
wherein the slider member is movable relative to the guide member.

10 33. The apparatus as claimed in claim 30, wherein the leg locking mechanism further
comprises

a guide member with an elongated guide slot; and
a slider member with an elongated slider slot,
wherein the locking pin comprises an engagement element configured to engage
15 with the elongated guide slot and the elongated slider slot,
wherein the locking pin is engaged to the elongated guide slot with the
elongated guide slot parallel to a longitudinal axis of the locking pin,
wherein the locking pin is engaged to the elongated slider slot with the
elongated slider slot at an angle with respect to the longitudinal axis of the locking pin, and
20 wherein the slider member is movable relative to the guide member.

34. The apparatus as claimed in claim 31, wherein the arm locking mechanism further
comprises

a guide member with an elongated guide slot; and
25 a slider member with an elongated slider slot,
wherein the locking pin comprises an engagement element configured to engage
with the elongated guide slot and the elongated slider slot,
wherein the locking pin is engaged to the elongated guide slot with the
elongated guide slot parallel to a longitudinal axis of the locking pin,
30 wherein the locking pin is engaged to the elongated slider slot with the
elongated slider slot at an angle with respect to the longitudinal axis of the locking pin, and
wherein the slider member is movable relative to the guide member.

35 35. The apparatus as claimed in any one of claims 32 to 34, wherein the engagement
element comprises a protruding element extending from the locking pin, the protruding element
being at least substantially perpendicular to the longitudinal axis of the locking pin.

36. The apparatus as claimed in claim 35, wherein the protruding element is engaged to the elongated guide slot and the elongated slider slot.

5 37. The apparatus as claimed in any one of claims 29 to 31, further comprising a pneumatic actuator coupled to the locking pin.

38. A method of off-loading a load from a truck or a trailer with the load supported by the apparatus of any one of claims 1 to 37 and with the apparatus mounted to the truck or the trailer,
10 the method comprising:

raising the truck or the trailer, using a height adjustment mechanism of the truck or the trailer, to raise the frame of the apparatus;

deploying the leg member of the outrigger assembly of the apparatus;

lowering the truck or the trailer, using the height adjustment mechanism of the
15 truck or the trailer, to lower the frame of the apparatus for the leg member to contact a ground;

lowering the truck or the trailer, using the height adjustment mechanism of the truck or the trailer, to detach the apparatus from the truck or the trailer.

39. The method of claim 38, further comprising unlocking the frame of the apparatus from
20 the truck or the trailer.

40. The method of claim 38 or 39, wherein the height adjustment mechanism of the truck or the trailer comprises a pneumatic suspension mechanism.

25 41. The method of claim 40, wherein deploying the leg member of the outrigger assembly of the apparatus comprises using the pneumatic suspension mechanism of the truck or the trailer to deploy the leg member of the outrigger assembly of the apparatus.

42. The method of claim 40 or 41, wherein deploying the leg member of the outrigger
30 assembly of the apparatus comprises unlocking the leg member of the outrigger assembly of the apparatus using the pneumatic suspension mechanism of the truck or the trailer.