

METHOD, SYSTEM AND APPARATUS FOR REMOVING CONTENTS FROM
CONTAINERS

FIELD OF THE INVENTION

This invention relates to a method, system and apparatus for removing contents from containers, especially standard freight containers. In particular this is to be achieved by tipping the containers. It also relates to pivotable mounting assemblies to secure releasably the containers in place whilst allowing them to be tipped. Additionally the invention relates to the transportation of material from one place to another.

BACKGROUND OF THE INVENTION

Containerisation, which allows easier handling, moving and transporting of cargoes is well established globally and accounts for a significant proportion of world trade volume annually. The essence of containerisation is the use of standard (freight) containers of standardised widths, heights and lengths. Such standard containers can be transported globally in the knowledge that almost every port and many railway yards are equipped to handle them.

Standard containers used in international freight movements may conform to the ISO-Norm (International Standardisation Organisation). There are also other standards such as Sealand. Aspects of the present application are applicable to standard containers of any standard. The ISO standard widths, heights and lengths are typically still in Imperial units: standard width being 8' (2½m); standard heights being 8' (2½-m), 8'6" (2½+m), 9'6" (3-m); and standard lengths being 10' (3m), 20' (6m) and 40' (12m). Indeed standard containers are referred to by their lengths. New standards can be added. The Sealand standard includes 35' (10½+m) and 45' (13½m) lengths.

Most standard containers are parallelepiped (i.e. rectangular boxes) in outer shape at least. This makes them easy to store and stack: no awkward shapes. Types of standard containers include: general purpose (six walls), open top containers (five walls), open side (no solid sides), flat (foldable end walls), platform (standard base, but no side or end walls), tank (no solid sides but a built-in tank for fluids), etc. Thus there are standard containers for almost everything. Individual goods can use most types, bulk materials also can use most types except the ones without solid sides, and liquids or gases the

more specialised ones. These have all the advantages of the specialised vessels and the advantages of the standard container shape and dimensions.

Each container usually has four corner castings (fittings) on its lower side. The majority of them also have four on top. A container rests on its lower castings. Where upper castings are present a container may support containers stacked on top of it, on its upper castings. Each corner casting has three free, outer faces, one for each of the sides for which it is a vertex. The upper- and lower-facing faces (i.e. the horizontal ones) have elongate apertures for receiving twist locks. There also tend to be apertures in both the other faces of each casting to allow the container to be lashed down.

What makes standard containers especially useful is not that they should all have solid faces but that they have structural struts at least forming a rectangular base. General purpose and some others also have them along the edges of each face: a total of twelve outer edge struts, four at each end and four connecting the two ends. The castings are welded at the junctions of these struts.

Handling of containers is commonly by means of a spreader (as is used at major container ports and terminals), lifting frames or hooks and chain/ropes, which engages the apertures of all four upper corner castings. The spreader or other means may be carried on a gantry within a building, a self-propelled gantry, or more typically, the headblock of an overhead travelling crane within a building, a rail-mounted gantry crane such as a quay crane, a free-ranging or otherwise mobile crane or the like, or on an attachment to a forklift truck etc. A container can also be handled by the slots at its base with a typical forklift truck. A container is lifted from one site and transferred onto a road or railway trailer, or vice versa.

Fig 1A shows a side view of a standard container 10 mounted on a typical road trailer 100 in a known manner. Two of the four lower castings 12 are apparent as are two of the four upper castings 14. The trailer is equipped with mountings 102 to support the container 10. Importantly, the mountings 102 are spaced at the correct positions, corresponding to the lower castings 12. This is one of the main advantages of using standard containers with their standard dimensions: the trailer 100 needs only have the mountings 102 at specific positions, and needs only to have the required strength at those positions. It makes the trailers simple and cheap. The same trailer can be used for standard freight containers throughout the world.

Individual items may be loaded into or unloaded from a container manually, or on a pallet by means of a pallet truck or forklift, or by means of an overhead lifting means in the case of an open-top container. However, for bulk granular materials and fluids, special equipment may be provided to transfer them into storage devices (tanks or silos), to be repackaged into smaller, more manageable containers (e.g. sacks or drums) or into specialised delivery vehicles or for further processing if necessary.

A specialised delivery vehicle is exemplified in Fig 1B. This shows a common tipper truck 200. It carries a bulk material 202 in a container 204, which is permanently fixed to the trailer 201 of the truck 200. The container pivots about a rear pivot 206 at one end. The truck is self-equipped for tipping; it has a hydraulic system, which is also a permanent part of the truck. This lifts up the other end of the container. As the container is tipped, the bulk material falls out of the back end, under a flap 210 onto the ground. Other known tippers have non-unitary trailers. During tipping, the rear wheel portion is separated from the front wheel portion and the rear wheels tip up as the container does. Other specialised delivery vehicles do not tip their containers but may have their own discharge compressors, pumps, valves, hoses etc.

OBJECT OF THE INVENTION

It is the primary object of the present invention to improve the current system of transport of cargoes. It is intended to make such transport cheaper and more efficient.

The present invention also aims to improve cargo transport itself.

SUMMARY OF THE INVENTION

According to a first aspect of the present invention, there is provided a pivotable mounting for a trailer, having a mounting surface and being shaped and dimensioned and made of a suitable material to secure releasably a fitting of a container to said mounting and to support said fitting.

Such a mounting should preferably be able to support at least half the weight of a container.

Preferably, the mounting further comprises securing means in said mounting for securing releasably a fitting of a container on said surface to said mounting whilst permitting a mounted container to be tipped about a pivot axis of said mounting.

As an additional or alternative option the mounting may include locking means having two operable positions, said locking means, in the first position, being arranged to engage with lock cooperating means in said trailer, when mounted on said trailer, to prevent pivoting of said mounting and, in the second position, being arranged so as not to engage said lock cooperating means in said trailer, when mounted on said trailer, to permit pivoting of said mounting.

According to a second aspect there is provided a trailer for a container, including pivotable means for allowing a container, at least one end of which is secured thereto, to be tipped up, relative to said trailer, about a pivot axis, whilst at least one end of said container is secured releasably to said trailer.

Preferably the trailer further comprises at least four mountings, one for at least each of four corner fittings of a container, to secure releasably a container onto said trailer.

It is also preferable that at least two of said mountings are rotatable relative to said trailer to allow a container mounted removably thereon to be tipped up, about a pivot axis. These could be end or side pivotable mountings or on a chassis pivotally mounted on said trailer about said pivot axis.

In either of the above trailers there may be securing means for securing said mountings to corner castings of a container mounted thereon and/or locking means for preventing pivoting of the pivotable mountings when there is no container mounted on those mountings.

The mountings can be mountings according to the first aspect of the invention.

The trailers may be for use on a railway and/or on a road.

There will be advantageous times when the trailers of the invention further comprise tipping means for tipping a container mounted removably thereon, relative to said trailer,

about said pivot axis. This could be, inter alia, a trailer-mounted crane or a jacking system.

According to a third aspect of the invention, there is provided a non-standard container having fittings spaced, shaped and arranged to be secured releasably to mountings on a trailer for a standard container.

There is also provided a trailer as above with such a non-standard container or with a standard container mounted removably thereon and secured releasably thereto.

According to a fourth aspect of the invention, there is provided a method of at least partially emptying contents from a standard container, comprising the step of tipping said container relative to said trailer, to empty, at least partially, contents of said container through an outlet port of said container.

Preferably the tipping step comprises lifting or pushing one edge of the container above the diagonally opposite edge.

According to a fifth aspect of the invention, there is provided a method of at least partially emptying contents from a container mounted on a trailer according to the invention, comprising the step of tipping the container, relative to said trailer, about said pivot axis to empty, at least partially, contents of said container through an outlet port of said container.

The fourth and fifth aspects may readily be combined.

In either step, prior to said tipping step, said container may be released from all mountings except the mountings which are to pivot in said tipping step.

According to a sixth aspect of the invention, there is provided a method of transporting material comprising the steps of:

- loading said material into a container at a production site;

- transporting said material from said production site to a site where it is to be transformed or used; and

- at least partially emptying contents from said container according to the method above at the site where said contents are to be transformed or used.

According to a seventh aspect of the invention, there is provided a method of delivering materials comprising the steps of:

- tipping a first container secured to a trailer relative thereto, to empty, at least partially, a first material from said first container;
- removing said first container from said trailer;
- securing a second container to said trailer in the place of said first container; and
- tipping said second container secured to said trailer relative thereto, to empty, at least partially, a second material from said second container.

According to an eighth aspect of the invention, there is provided a method of delivering material, comprising the steps of:

- securing removably and releasably a container containing material to a trailer;
- moving the trailer and container thereon to a delivery site; and
- tipping said container on said trailer relative thereto, whilst secured to said trailer, to empty at least a portion of said material from said trailer.

Again in these aspects of the invention, the trailer may be as above.

The seventh and/or eighth aspects of the invention may readily be combined with the third, fourth and/or fifth aspects of the invention.

According to a ninth aspect of the invention, there is provided a method of determining the order in which cargoes are to be delivered, comprising the step of using distances between cargo pick up and delivery points and given that the method of delivery comprises the method above, to optimize said order.

According to a tenth aspect of the invention, there is provided a method of modifying a trailer for carrying a container, comprising the step of attaching at least one pivotable mounting according to the first aspect of the invention to said trailer.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be further described by way of non-limitative example with reference to the accompanying drawings, in which:-

Figure 1A shows a known trailer and standard container configuration;

Figure 1B shows a known tipper truck;

Figure 2A illustrates a configuration of trailer according to a first embodiment of the invention and standard container of a first type;

Figures 2B and 2C illustrate configurations of the same trailer according to the first embodiment of the invention and other standard container types;

Figure 3 illustrates the rear portion of the trailer of Figure 2A to 2C;

Figures 4A and 4B illustrate a mounting in the rear portion of the trailer of Figures 2A to 2C and 3;

Figure 5 illustrates a configuration of a trailer according to the second embodiment of the invention and a standard container;

Figure 6A illustrates a self-equipped tipper trailer, according to a third embodiment of the invention;

Figure 6B illustrates a configuration of trailer equipped with a crane according to a fourth embodiment of the invention, and a standard container;

Figure 7 illustrates an alternative mounting portion, according to a fifth embodiment of the invention;

Figure 8 illustrates another alternative mounting portion, according to a sixth embodiment of the invention;

Figure 9 illustrates again another alternative mounting portion, according to a sixth embodiment of the invention;

Figure 10 illustrates yet another alternative mounting portion, according to a seventh embodiment of the invention.

DESCRIPTION OF EXEMPLIFIED EMBODIMENTS OF THE INVENTION

Referring to Fig 2A, a standard container 10 (whether of the ISO or Sealand or other standard or whether general purpose, open top, open side, flat, platform, tank or other type) is mounted on a trailer 20 according to a first embodiment of the invention. The trailer 20 is similar to a standard trailer for transporting standard containers. It has two mountings 102 at the front and two mountings 30 at the rear. As with the prior systems, these four mountings are spaced and designed to correspond to, cooperate with and support fittings 12, in this case the lower corner castings 12 of the standard container 10. However, the two rear mountings 30 are different from the other two 102. They are able to pivot about a pivot axis 32, even whilst the container is still locked onto them by way of a twist lock 34 or the like. Additionally, the rear mountings 30 have sufficient support to ensure that they are strong enough to bear at least part and preferably all of the weight of a full container, tipped up and resting on them. The pivot axes 32 for the two pivotable mountings 30 are the same pivot axis.

Whilst in this illustrated embodiment it is the two rear mountings 30 that are pivotable, it could instead be the front mountings, side mountings or all mountings.

In use a standard container 10 is loaded onto the trailer 20 in any one of a number of different ways, including those mentioned earlier. It is locked into place using standard twist locks 34 in its four lower castings 12 cooperating with the four mountings 30, 102 in the trailer. It is then driven or otherwise brought to its destination. At the destination, the twist locks 34 in the two front mountings 102 and corresponding corner castings 12 are then unlocked, although the rear ones are not. The rear door 16 is then opened. A hoisting means of some sort is then attached to the top front of the container 10, preferably to the two upper front corner castings 14. This hoisting means lifts the front of the container 10 off the trailer 20, pivoting it on the rear mountings 30 about the pivot axis 32 relative to the trailer. The contents of the container are then able to fall out under gravity through the open door 16 onto the ground or whatever other surface, container or conveying equipment is present.

Bulk fluid material, like liquid, grain etc, is able to flow by gravity; discharging of such material is easily done by tipping the container. No transfer pump or power unit need to be provided and this entails cost savings and simple skid design; furthermore, with standard containers universal portability is assured.

This embodiment is suited for transferring of cargo to or from the site that has a raising means, such as a hoisting means. Such hoisting means may include an overhead travelling crane, a rail-mounted gantry crane, a rubber-tyred gantry crane, a track crawler crane, a hoist carried on a jib, a crane mounted on another vehicle, or any other hoisting equipment. Since most commercial and industrial premises have a hoisting means of one type or another, there is no need to provide the trailer with any hoisting means.

The container is safe on the trailer 30 during tipping because it is secured to the rear mountings 30.

The same trailer not only can carry standard containers with doors 16 but also those with rear flaps 18, as in Figure 2B or standard fluid containers 120, as in Figure 2C. Of course, other types of standard container can be used.

It is further understood that tipping the container also help to maximise the effective discharge of contents from the container when other discharge methods, such as pneumatic conveying, pressurising, suction, etc are being used. These combination discharge methods are especially useful with the type of container illustrated in Figure 2C, which is used for bulk materials.

The present invention used with standard fluid containers 120 is especially useful when there are content spillages or safety hazards at every transfer of the material.

The present invention as embodied here has the advantage that it does not need specialist equipment at the point of delivery to empty, beyond a hoist. Thus hardcore and other building materials can be delivered straight to a building site in a standard container on a trailer of the present invention. It does not require a specialised delivery vehicle. The building site will have the crane or other hoist already. Further, the same trailer can be used to deliver a building material (cleaned if necessary) and then immediately after used to deliver a liquid, foodstuffs or some other incompatible material. Once one cargo has been delivered, the container may be removed in the standard manner and replaced with a different container with a totally different cargo. It is only the containers that change and only they, if anything, that need to be dedicated. Thus, since the same trailer can be used to deliver any number of different materials to different or the same users, it is no longer necessary to have numbers of dedicated delivery vehicles sitting idle.

Moreover, the container can be the same one from original supplier to customer. It can be filled at the farm, factory or quarry, taken to a port without unloading, put straight onto any container-bearing ship (without waiting for a silo to fill or dedicated ship to arrive) taken off the ship using standard handling equipment and put straight onto a road or rail trailer and taken to the final customer. Thus all specialised handling equipment between producer and consumer, silos and specialised delivery vehicles are dispensed with. Costs are down, as is total delivery time.

Figure 3 illustrates the rear portion of the trailer chassis 20. It shows the two pivotable rear mountings 30 mounted on the ends of a horizontal strut 22 of the trailer 20. As mentioned before, the two pivotable rear mountings 30 correspond to the positions of the two lower rear corner castings of a standard container and are provided on the trailer for securing the container thereon.

A twist lock 34 is typically used to secure the container in place, although other securing means may be used. The securing means should be able to restrain the container fully, that is, in the x-, y- and z- directions. Other options for use as securing means may be: a bolt and nut; a pin with a mushroom head at one end and a hole at the other for a lock pin; a pin with a transversely welded bar at one end and a detachable lock plate at the other; a pin with an enlarged shoulder at one end and a circumferential groove at the other for engagement with an annular but split key, a housing to hold the split key, and the housing being tightened to the pin etc. For the purpose of simplifying and illustrating the principle of the invention, only a twist lock as a securing means is described, although the possibilities mentioned above and others all fall within the scope of the present invention. It is further understood that these securing means can provide simple, quick, easy locking and unlocking of containers onto the mountings for container tipping and lowering, and at the same time also enable simple, quick and easy placing and removing of containers onto and from the trailer.

Figs 4A and 4B illustrate in more detail the mountings 30 at both ends of the strut 22 and twist locks 34 shown in Fig 3. Fig 4A is a closer perspective view, whilst Fig 4B is a top plan view. Each mounting 30 is pivotably mounted on a journal 36 about a pivot axis 32. Journal 36 is welded to mounting 30. The journal rotates in journal bearing 44. There is no need to lock the journals 36 into their bearings 44 whilst a container 10 is secured to the mountings, since neither could fall out, but some means of securing them may be

necessary for the times when there is no such container 10. A groove and annular split key or other well-known arrangement could well suffice. Although journal 36 is preferably welded to mounting 30, other means of connection are possible, including detachable means, including bolted link bars et al. Of course, journal 36 may extend across the width of the trailer, for example, and the two mountings 30 share a common journal. Similarly, two adjacent pivotable mountings may simply share a common journal. The journal or journals can be replaced with a non-rotating shaft or non-rotating shafts, on which the mountings rotate.

Each twist lock 34 is made up of a shaft journalled in a sleeve 40, with an arrow-shaped or mushroom head 42 at one end of the portion of the shaft passing through the sleeve 40 and a transverse lever 35 at the other end. The mushroom head is elongate in a direction perpendicular to the axis of the shaft to which it is joined. The head 42 and a portion of the sleeve pass through a hole 38 in the top surface of the mounting 30. When a container is mounted on the trailer, the head 42 passes through the elongate aperture in the lower face of the corresponding casting 12. Once the casting 12 has been located onto the twist lock head 42, the twist lock shaft is turned through 90° in the sleeve 40 by means of a lever 35 joined to and perpendicular to the shaft. The lower surfaces of the mushroom head 42 of the twist lock 34 engage with the upper side of the lower face of the casting 12, along the edges of the aperture, thereby securing the container 10 to the mounting 30. Similar arrangements can be used for securing the container castings 12 to all four mountings 30, 102.

When no container is mounted, the mounting should be constrained from rotation for safety purposes. Thus a locking means is provided. A plunger 46 is provided at the inner corner of the top surface of the mounting, with respect to the twist lock 34. The mounting also has an associated locating pin 48, which passes through a corresponding hole in the side of the mounting 30. There is also a lock cooperating means for the locking means, in the trailer. In this instance it is a hole in the end of the strut 22. The plunger 46 is depressed by a container 10 mounted on the top surface of the mounting. It is also connected to the locating pin 46 in such a way that when, depressed, it pulls the pin 48 out of the strut end to allow relative rotation between the strut 22 and mounting 30. This could, for instance be achieved by passing the lower end of the plunger 46 through a hole in the pin 48, where the inner surface of that hole and the outer surface of the plunger would have cooperating cam surfaces. A spring on the pin 48 and/or on the plunger 46 would ensure that they return to their locking positions when there is no container on the

plunger 46. This feature provides for a fail-safe operation of the present invention. Without this feature, a manually retractable locating pin can inadvertently be left in the lock position; tipping a container box in this situation would lead to an accident.

Of course the plunger 46, locating pin 48 and hole in the mounting can be in other positions. Further, other locking means may be equally suitable. For example, instead of a rigid locking means, there may be a spring-loaded detent (eg, a pin or a ball) extending from one of the mounting and the trailer and a recess in the other one of the mounting and the trailer into which the detent will fit. This will locate the home position of the pivotable mounting. One of the detent and recess at least should preferably have a curved or cam surface. Preferably the mounting could be pivoted away from and back to the home position by hand.

Fig 5 illustrates a second embodiment of the invention. The figure shows a standard container 130 with an open top. This type of container may be ISO or Sealand type and may further include other types for local use, such as those from farms and mines, which have characteristically lower heights for ease of emptying the contents. The container 130 is mounted on a trailer 50 on a railway 54 (railway carriage). The two pivotable mountings 52 are along one side of the trailer 50, pivotable about a common pivot axis, thus allowing the contents of the container to be tipped over the side. This is a most advantageous arrangement for railway use, where the ends of each trailer 50 (carriage) are not accessible.

In this illustrated embodiment, the two mountings 102 along the other side of the trailer 50 are fixed. However, they could easily be replaced with pivotable mountings 52, so that the contents of the container 130 could be tipped over either side. The twist locks or other securing means on the other side from the side over which the contents are to be tipped would be the ones to be released. Moreover, each trailer is not limited to four mountings, for only one container. There could be more mountings for more than one container, which allow all the containers to be tipped over the same and/or different sides. Further, the side-tipping trailer and the multi-container trailer are not limited to railway use. It is equally possible to have such pivotable mountings 52 on other trailers too. The present invention also encompasses other possibilities, e.g. where the pivotable mountings can pivot about both side axes and end axes of the trailer and where they allow containers to be tipped up about either end.

Fig 6A illustrates a trailer according to a third embodiment of the invention. In this figure a container 10 is mounted on top of a pivotable chassis 62, on a trailer 60. The chassis 62 can have the standard mountings 102 to mount the container 10. None of them needs to be pivotable, but the chassis 62 itself does need to pivot about axis 64. In the embodiment it is illustrated that the pivot axis 64 is at the rear of the trailer, but it will be understood that it could be about either end or either side. At least one hydraulic jack 66 is provided for pushing the chassis 62 up from the lower side and to pivot the chassis 62 about the pivot axis 64. Of course other raising means, for example a crane could be used to raise the chassis 62.

Fig 6B illustrates a trailer according to a fourth embodiment of the invention. This embodiment is the same as the first embodiment, with the same mountings etc, but differs in that the trailer 70 has a crane 72 mounted on the front end. This is used to lift the one end (or side) of the container 10, to tip its contents out of the other end (or side). In the embodiment it is illustrated that the pivot axis 64 is at the rear of the trailer, but it will be understood that it could be about either end or either side. Likewise, the crane 72 does not need to be positioned at the front end, but could be at the rear, or even on a separate unit temporarily incorporated into the trailer.

A variation on these two embodiments is to have a trailer with an hydraulic jack 66, as in Fig 6A and with a removable pivotable chassis 62. The pivotable chassis could be a rigid chassis mounted on pivotable mountings, for instance mountings 30 or 52 mentioned earlier. Thus the jack 66 could act on the chassis bearing a container. Alternatively the chassis could be removed and a container secured at the pivotable mountings 30, 52. Then the jack 66 acts directly on the container 10. The point of action may be on one or more of the base or end struts or other suitable points. The invention also encompasses a container with a retractable arm (whether by pivoting, sliding or otherwise) in its end face which can be used to push (or pull) the end of the container up. Other positions are also possible. Although there may be instances where an unmodified base of a container may be strong enough to support the container's weight, it is advantageous to use containers with strengthened struts across the base if the base is to support the weight. It is also advantageous if the base of the container is adapted to allow quick and effortless coupling with the rod end of hydraulic jack 66.

The third and fourth embodiments and their variations are particularly suited for transferring cargoes to remote places or to places that do not have their own lifting

facilities. Whilst more expensive than a trailer of the first embodiment, they would still be cheaper than dedicated delivery vehicles that are used less frequently. Other variations of these embodiments include, inter alia, tipping the container by means of at least one hydraulic jack acting on a beam and hoisting the upper forward edge of the container and tipping by means of two cranes, one mounted at the forward side of the container and another at the rear side, etc.

Fig 7 illustrates another, fifth embodiment, this time of the mounting 80 on the end of strut 22. In this instance the mounting 30 uses a ball joint 82 to pivot. A wear plate 84 is provided on the mounting side to constrain the free rotation of the ball joint 82 to only about its shaft axis, although the wear plate 84 could be on the strut side. An advantage of the ball joint is that it overcomes inaccuracies inherent in welded fabrication. The wear plate 84 may, of course, be left out of this embodiment.

In the above embodiments illustrated in Figs 4A and 7, the journal 36 and the ball joint 82 should be sized so that the forces acting on them are safely supported. Fig 8 illustrates yet another embodiment, a sixth embodiment. In this instance the mounting 90 is not attached horizontally onto the end face of the strut 22, rotating on that end, but is incorporated into a curved recess 96 in the strut 22. The recess 96 is in the top and rear surfaces of the strut 22. It appears as a quarter circle, looking from the end of the strut 22 and is rectangular, looking from the top or from the rear. The mounting 90 has an outer shape corresponding to that of the recess. It sits in the recess 96 and pivots about a pin 92. With this arrangement, the forces experienced by the mounting 90 transfer from the mounting outer rocking surface 94 to the recess rocking surface. Thus they are transmitted directly to the strut 22 and the trailer. In this instance, the pin 92 provided at the centre of rotation of the surface 94 may be significantly smaller than the earlier journal 36 or ball joint 82. Whilst in this embodiment the recess 96 appears rectangular, looking from the rear or on top, it may appear to be square, or other shapes, such as trapezoidal.

The rocking surfaces of the above embodiment can be used with other pivots, for instance as discussed earlier.

A desired variation of the pivotable mountings is for them (or at least some of them) to have at least two perpendicular pivot axes. This allows a container to be tipped up about either of both a side and an end of the trailer. Such an embodiment can be easily achieved, for instance as shown in Fig. 9. A strut 23 provides pivot journals 45, 46 to

extend at perpendicular angles into mounting 31. Each journal 45, 46 has two positions: extended (into the mounting 31) and retracted (into the strut 23). Only one may be in its retracted position at any time (so the mounting does not drop), but both may be in their extended positions (to lock and support the mounting in position). The journals can use shared or separate actuators to move back and forth and/or can have handles for that purpose.

Another biaxial variation is to provide a partially spherical rocking surface recessed in the strut 23, with two retractable pivot pins, actuators and/or handles. The spherical rocking surface essentially supports the load at the mounting and these pivot pins may be smaller than the pivot journals. Also biaxial pivoting is possible for single ball joints, rather than two pivot axes.

Fig 10 illustrates another safety feature. In this embodiment, the pivotable mounting 98 is provided with two support guides 99 for the mounted corner casting of the container. The support guides 99 have two portions, one extending generally upwards above the top surface of the mounting 98, parallel to the outer edges of the mounting 98 and the other angled further outwards from the top of the first portions. Containers are fabricated by welding and there are tolerances in the positions of the corner castings in relation to each other. The mounting apertures at the lower side of the container are similarly inaccurate. Given such tolerances and the clearances for engagement between the twist lock and the mounting apertures, the support guides 99 are provided for each pivotable corner to limit the movement between the mountings 98 and castings when the container is tipped. Further, the support guides 99 may prevent accidental movement if the securing means is not present or has malfunctioned. Whilst two support guides 99 are illustrated per mounting, only one may be necessary, to guard against motion in the direction in which a tipped container would tend to slip.

In all of the embodiments, once the contents of the container have been discharged, the container is replaced back in the correct horizontal position effortlessly by simply lowering the front or side of the container, as appropriate. When the container has been returned to the horizontal position, the twist locks in the front (or side) mountings are turned to the locking position again to secure releasably their respective castings, thus, ensuring the container is safe for transportation again. Once the container is returned to the horizontal position, all the twist locks can be unlocked easily and the emptied container removed quickly from the trailer. Thereafter, another container can be positioned onto the same

trailer with ease and secured releasably with the twist locks again and may be ready for immediate dispatch. The cycle may be repeated as necessary.

The various illustrated embodiments of trailer only show two mountings along each side of the trailers. Of course, there can be more along each side or edge, perhaps to accommodate different length standard containers. For example, there could be mountings every 5' ($1\frac{1}{2}+m$). This would allow various combinations on, say, a 45' trailer, e.g. a 10' container, 5' space, 10' container, 5' space, 10' container or 20' container, 5' space, 20' container. Alternatively, rather than having all the mountings in fixed position, they could be positionable at almost any point along the trailer. This could be achieved by having them slide on rails, or making them removable to be reattached at any one of a number of positions. This would remove or reduce the wasted space between containers. When there are multiple mountings along a side, it is useful if all mountings along a single side or edge over which a container may pivot are also pivotable about the same axis or axes. In the case of a trailer having multiple mountings for handling various lengths of containers or multiple containers, the mountings not to be used in an instance may be moved to a clear position, for example, by pivoting or retracting part of the strut or whatever else it is to which they are attached. This is particularly useful for a trailer to be able to handle a variety of container lengths, for example either three 10', two 20', one 40' or one 45' container without having to specify the trailer type for a particular transport.

In the illustrated embodiments, one manually pushes a lever to turn the twist lock shaft. However, this could be achieved by means of an actuator, either acting on a lever or on the shaft. Remote activation of the twist lock enables automatic or semi-automatic locking of a container. With a provision for an over-ride feature, which is common for pneumatic or hydraulic systems, this would allow manual turning of the twist lock in the event of a breakdown of the remote activation system.

A safety feature for all trailer embodiments of this invention, to prevent over-tipping of a container, is a safety chain (rod or other link) having one end attached to the trailer and the other end attached to the container, for instance to the underside. The link may be fixed length or extensible within a fixed limit. In this way, a maximum and safe angle of tipping can be ensured. The link should be at least detachable at one end, preferably detachable from at least the container.

The illustrated embodiments show some trailers being integral with a cab, and others not. This is in no way considered to be essential. For example trailers of the first embodiment may have integral cabs, whilst some of the third embodiment may not. The term "trailer" is not intended to be construed solely to refer to container-bearing platforms that are trailed. The present invention covers all platforms for bearing containers, whether they are pushed, pulled, self-propelling, immobile or otherwise.

Another important aspect of the present invention is the applicability of at least some of its aspects to non-standard containers (e.g. ones that are over- or under-sized in one or more directions or ones that are not parallelepiped in outer shape) and even non-containers. Easy detachability and interoperability of any tipping load has great advantages in itself. It is especially useful if the non-standard containers and/or non-containers have at least lower castings (or other fittings) in the same positions and with the configurations that would allow them to be attached to and removed from a trailer as if they were standard containers.

For example some tipper trucks use a tipper which is wider than a standard container and has a lip or other parts at the very rear which extend below the lower floor level of the tipper, over the back of its trailer. Such a tipper could be used with the trailer of this embodiment provided it has fittings that allow it to be secured to the mountings of that trailer and tipped up on it, whilst still secured to the pivotable mountings along one side or edge.

Other examples are roll-on containers, for instance of the type frequently used for holding rubbish. They tend to have five or six solid sides and sit on the ground on two parallel rails. When these containers are to be moved, one end is lifted over the end of a trailer and pulled along the length of the trailer. The trailer has one or more rollers or wheels which roll against the rails as the container is dragged onto the trailer, thus making the dragging action possible. Such a system allows a container to be loaded onto a trailer without the need for a crane to support the container's entire loaded weight. A trailer with four mountings for standard containers could be fitted with such rollers or wheels for roll-on containers to be dragged on or off. There would have to be sufficient clearances and the possibility of movement for the mountings for the roll-on container to be secured releasably to the mountings. This could be combined with pivotable mountings or the pivoting chassis of the present invention.

The present invention has the full advantages of simple and effective tipping and replacing of a container using pivotable mountings provided on a trailer and, at the same time, also enables the simple and effective placing, detaching and removing of containers onto and from a trailer.

Using the present invention, trailers having a container attached permanently onto them can now be altered and retrofitted in such a way that other containers can instead be easily placed onto and detached from them in the same way as a standard freight container on a standard trailer, thus reaping the benefits of pivoted tipping and replacing of the containers.

One more advantage of the present invention is that it integrates readily into existing systems, simply by-passing them without needing new material-handling equipment. As for the trailers, they can be produced new with the pivotable mountings or chassis or else pivotable mountings can be retrofitted, after any relevant fixed mountings in the way have been removed. Of course the entire strut (22 in some of the embodiments) may be replaced for ease of retrofitting. For adjacent pivotable mountings, such as those at the end or provided to secure and tip one or more containers along their sides, a common pivot journal is particularly useful.

Another advantage of this invention is that when the container is tipped up, all the tyres of the trailer may remain on the ground (including rails). In this way, over-loading of both the wheel axle nearest the pivot axis and the underlying ground below the tyres may be avoided. It is also safer and cheaper than trailers where some of the wheels leave the ground. Safety can also be improved if the pivot axis is to the trailer side of the wheel axis for the last set of wheels, so that the load on the mountings tends to keep the trailer level, rather than tipping it up.

In brief and non-limiting summary, this invention provides improved methods, systems and apparatus for transporting cargoes in containers that can be secured to a trailer using mountings for standard containers. The same trailer can be used for non-standard loads. A modified trailer allows containers of almost any size or shape to be tipped up, whilst still secured to mountings on the trailer. This is especially advantageous for bulk materials and liquids, where such a tipping action allows the material to flow out of the container onto a floor or into another container for use. Since this allows materials to be delivered to consumers in standard containers, the same container can be used to

transport the material from the producer to the user, without need for intermediate unloading and reloading into another container or re-packaging, even if the journey includes sea travel. This avoids the need for dedicated silos, transfer equipment and specialised delivery vehicles. It also reduces transportation times and costs.

The invention also encompasses delivery systems whereby a first container with a first material is placed on a trailer, taken to a customer, tipped up to empty or part empty it (perhaps through a measuring device) then at another point removed and replaced with a second container with the same or a different cargo and that too tipped up to empty or part empty it for another or the same customer.

The invention also encompasses improved methods for determining the order in which cargoes are to be delivered. Given the delivery system of the present invention allows one trailer to do all the delivery, the order of delivery can be determined taking that and distances into account. This is especially useful if there are a limited number of people able to make the deliveries.

While only a few embodiments of the present invention have been described and illustrated, it is to be understood that many changes, modifications and variations could be made to the present invention without departing from the scope of the invention. For instance the different mountings could be used on any of the discussed trailers. Numbers of mountings and directions of rotation can also vary, either to improve multi-functionality or for specific uses.

CLAIMS

1. A pivotable mounting for a trailer, having a mounting surface and being shaped and dimensioned and made of a suitable material to secure releasably a fitting of a container to said mounting and to support said fitting.
2. A pivotable mounting according to claim 1, further comprising securing means in said mounting for securing releasably a fitting of a container on said surface to said mounting whilst permitting a mounted container to be tipped about a pivot axis of said mounting.
3. A pivotable mounting according to claim 2, wherein said securing means comprises:
 - a twist lock sleeve to one side of said mounting surface;
 - a twist lock, rotatable in said sleeve and passing through a hole in said mounting surface and having a head on the other side of said mounting surface from said sleeve; and
 - a pivot having an axis perpendicular to that of said twist lock sleeve to mount said mounting pivotably on said trailer;wherein the head of said twist lock is operable to engage a fitting of a container positioned on said mounting surface and to secure it to said mounting.
4. A pivotable mounting according to any one of the preceding claims, further comprising locking means having two operable positions, said locking means, in the first position, being arranged to engage with lock cooperating means in said trailer, when mounted on said trailer, to prevent pivoting of said mounting and, in the second position, being arranged so as not to engage said lock cooperating means in said trailer, when mounted on said trailer, to permit pivoting of said mounting.
5. A pivotable mounting according to claim 4, wherein said locking means is moveable from said first to said second position by placing of a fitting of a container against said mounting surface and is biased towards said first position.
6. A pivotable mounting according to claim 4 or 5, wherein said locking means comprises:



a plunger; and
a locating pin; wherein

said plunger extends above said mounting surface to be depressed by a casting of a container secured to said mounting, thereby moving said locating pin for engagement with said cooperating means.

7. A pivotable mounting according to any one of the preceding claims, being pivotable about at least two substantially perpendicular axes.
8. A pivotable mounting according to any one of the preceding claims, further comprising at least one journal rotatably located therein for the mounting to pivot thereon.
9. A pivotable mounting according to any one of the preceding claims, further comprising at least one ball joint rotatably located therein for the mounting to pivot thereon.
10. A pivotable mounting according to any one of the preceding claims, further comprising at least one pivot pin rotatably located therein at the centre of rotation for the mounting to pivot thereon.
11. A pivotable mounting according to any one of the preceding claims, further comprising at least one rocking surface for sliding contact with at least one corresponding surface on said trailer.
12. A pivotable mounting according to any one of the preceding claims, further comprising at least one guide protruding beyond said mounting surface for guiding positioning of a fitting of a container on said mounting.
13. A pivotable mounting according to claim 12, wherein said at least one guide is arranged to prevent sliding movement between said mounting surface and a fitting of a container thereon.
14. A pivotable mounting according to any one of the preceding claims, shaped and dimensioned for use with a standard container.



15. A trailer for a container, including pivotable means for allowing a container to be tipped up about a pivot axis relative to said trailer, whilst at least one end of said container is secured releasably to said trailer.
16. A trailer according to claim 15, wherein said pivotable means have at least two pivot axes, allowing a container mounted thereon to be tipped up about either or any of said pivot axes, relative to said trailer.
17. A trailer according to claim 15, further comprising at least four mountings, one for at least each of four corner fittings of a container, to secure releasably a container onto said trailer.
18. A trailer according to claim 17, wherein said mountings are operable to secure releasably a standard container to said trailer.
19. A trailer according to claim 17 or 18, wherein at least two of said mountings are rotatable relative to said trailer to allow a container mounted removably thereon to be tipped up, about a pivot axis.
20. A trailer according to any one of claims 17 to 19, wherein at least two of said mountings are pivotable, to allow a container mounted removably thereon to be tipped up, about said pivot axis of said at least two mountings.
21. A trailer according to any one of claims 17 to 20, wherein at least the two rear mountings of said trailer are pivotable.
22. A trailer according to any one of claims 17 to 21, wherein at least two side mountings of said trailer are pivotable.
23. A trailer according to any one of claims 17 to 19, further comprising a chassis mounted pivotably on said trailer about said pivot axis and wherein said at least four mountings are provided on said chassis.
24. A trailer according to claim 23, further comprising at least two pivotable mountings on which said chassis is removably pivotably mounted.



25. A trailer according to any one of claims 20 to 22 and 24, wherein the pivotable mountings are pivotable mountings according to any one of claims 1 to 14.
26. A trailer according to any one of claims 15 to 25, further comprising securing means for securing releasably said mountings to corner fittings of a container mounted removably thereon.
27. A trailer according to any one of claims 17 to 26, wherein the mountings are shaped and dimensioned for twist locks to secure said container releasably thereto.
28. A trailer according to any one of claims 17 to 27, further comprising linking means, attachable between the trailer and a container mounted thereon to limit the tipping angle between trailer and container.
29. A trailer according to any one of claims 17 to 28, operable to tip a container mounted thereon, without tipping wheels of the trailer off the ground.
30. A trailer according to any one of claims 17 to 29, operable to tip a container mounted thereon, without causing the portions of the trailer away from the pivot axis to tip.
31. A trailer according to any one of claims 17 to 30, wherein at least two of said mountings are movable to different positions along the sides of the trailer.
32. A trailer according to any one of claims 15 to 31, being a trailer for use on a railway.
33. A trailer according to any one of claims 15 to 32, being a trailer for use on a road.
34. A trailer according to any one of claims 15 to 33, further comprising tipping means for tipping a container mounted on said trailer about said pivot axis.
35. A trailer according to claim 34, wherein said tipping means comprises a crane mounted on said trailer.



36. A trailer according to claim 34 or 35, wherein said tipping means comprises at least one jacking system for causing the end of the container, opposite to the end nearest the pivot axis, to move upwards.
37. A trailer according to any one of claims 15 to 36 shaped and dimensioned for securing releasably a standard container mounted thereon.
38. A trailer according to any one of claims 15 to 37, further comprising a container mounted removably thereon and secured releasably thereto.
39. A non-standard container having fittings spaced, shaped and arranged to be secured releasably to mountings on a trailer for a standard container.
40. A trailer according to any one of claims 15 to 37, further comprising a container according to claim 39 mounted removably thereon and secured releasably thereto.
41. A system for emptying a container, comprising a trailer according to any one of claims 15 to 38 and 40 and raising means for raising the diagonally opposite edge of a container, mounted removably on said trailer, with respect to the pivot axis.
42. A system according to claim 41, wherein said raising means is an overhead travelling crane.
43. A system according to claim 41 or 42, wherein said raising means is a rail mounted gantry crane.
44. A system according to any one of claims 41 to 43, wherein said raising means is a rubber-tyred gantry crane.
45. A system according to any one of claims 41 to 44, wherein said raising means is a mobile crane.
46. A system according to any one of claims 41 to 45, wherein said raising means is a hoist mounted on a jib.



47. A system according to claim 41, wherein said raising means is a self-equipped jacking means acting on a beam or a system of linked structural struts.
48. A method of at least partially emptying contents from a standard container, comprising the step of tipping said container to empty, at least partially, contents of said container through an outlet port of said container.
49. A method according to claim 48, wherein the tipping step comprises lifting one edge of the container above the diagonally opposite edge.
50. A method according to claim 48, wherein the tipping step comprises pushing one end or side of the container above its opposite end or side.
51. A method according to any one of claims 48 to 50, wherein said contents are fluid.
52. A method according to any one of claims 48 to 51, wherein said contents are bulk material.
53. A method according to any one of claims 48 to 52, wherein said contents are liquid.
54. A method according to any one of claims 48 to 52, wherein said contents are granular or powdery materials.
55. A method of at least partially emptying contents from a container mounted on a trailer according to any one of claims 15 to 38 and 40, comprising the step of tipping the container, relative to said trailer, about said pivot axis to empty, at least partially, contents of said container through an outlet port of said container.
56. A method according to any one of claims 48 to 54, wherein said container is mounted on a trailer according to any one of claims 15 to 38 and 40.
57. A method according to claim 55 or 56, when dependent on at least one of claims 20 to 22, further comprising the step, prior to said tipping step, of releasing said container from all mountings except the mountings which are to pivot in said tipping step.



58. A method according to claim 57, wherein said releasing step comprises releasing twist locks on all mountings except the mountings which are to pivot in said tipping step.
59. A method of transporting material comprising the steps of:
loading said material into a container at a production site;
transporting said material from said production site to a site where it is to be transformed or used; and
at least partially emptying contents from said container according to the method of any one of claims 48 to 58 at the site where said contents are to be transformed or used.
60. A method of transporting material according to claim 59, wherein said contents are not unloaded from said container in between said loading and removing steps.
61. A method of transporting material according to claim 59 or 60, wherein said transporting step includes transporting said container by water-going craft between said loading and removing steps.
62. A method of transporting material according to claim 60 or 61, wherein said transporting step includes transporting said container by air-going craft between said loading and removing steps.
63. A method of delivering materials comprising the steps of:
tipping a first container secured to a trailer relative thereto, to empty, at least partially, a first material from said first container;
removing said first container from said trailer;
securing a second container to said trailer in the place of said first container; and
tipping said second container secured to said trailer relative thereto, to empty, at least partially, a second material from said second container.
64. A method of delivering material, comprising the steps of:
securing removably and releasably a container containing material to a trailer;



moving the trailer and container thereon to a delivery site; and
tipping said container on said trailer, whilst secured to said trailer, to empty
at least a portion of said material from said trailer.

65. A method according to claim 63 or 64, wherein the trailer is as defined in any one of claims 15 to 38 and 40.
66. A method according to any one of claims 63 to 65, wherein at least one of said tipping steps comprises a method according to any one of claims 48 to 58.
67. A method according to any one of claims 48 to 66, wherein at least one of said tipping steps is carried out without it requiring or causing wheels to be lifted off the ground.
68. A method according to any one of claims 48 to 67, wherein the container is a container as defined in claim 39.
69. A method of determining the order in which cargoes are to be delivered, comprising the step of using distances between cargo pick up and delivery points and given that the method of delivery comprises the method of any one of claims 48 to 68, to optimize said order.
70. A method of modifying a trailer for carrying a container, comprising the step of attaching at least one pivotable mounting according to any one of claims 1 to 14 to said trailer.
71. A method of modifying a trailer according to claim 70, further comprising the step of removing at least one non-pivotable mounting prior to said attaching step.