(54) Title: MODULAR DRILL SYSTEM REQUIRING LIMITED FIELD ASSEMBLY AND LIMITED EQUIPMENT SUPPORT AND METHOD OF USE

(57) Abstract: A modular transfigurable drilling rig comprises one or more transfigurable containers with drilling equipment to form an operational drilling rig. The transfigurable containers include a first and second load bearing support and a load bearing bottom disposed between the first and second load bearing supports, thereby forming a space. The container includes drilling equipment rotatably attached to the load bearing supports or the load bearing bottom. The drilling equipment is disposed within the space. The drilling rig further includes one or more connectors adapted to engage at least two transfigurable containers together. The drilling rig further includes piping adapted to connect the drilling equipment together, cabling adapted to provide communication between the drilling equipment, and a power source connected to the drilling equipment, wherein the power source is adapted to provide power to the drilling equipment. Further, embodiments for methods of construction and transport of a modular drilling rig are embodied herein.
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MODULAR DRILL SYSTEM REQUIRING LIMITED FIELD ASSEMBLY
AND LIMITED EQUIPMENT SUPPORT AND METHOD OF USE

RELATED APPLICATION INFORMATION
This application claims the benefit of priority of U.S. Provisional Patent Application Serial No. 60/567,660, filed in the United States Patent & Trademark Office on 3 May 2004 and entitled "TransfigurableView Shipping Container for Drilling Equipment."

FIELD OF THE INVENTION
The present embodiments relate generally to methods for a transfigurable standardized shipping container for drilling rigs.

BACKGROUND OF THE INVENTION
A need exists for a system to provide a standardized transfigurable container system because shipping non-standard containers is expensive and difficult.
A need exists for a modular drilling rig system and method that provides a drilling rig that can be easily assembled or "unfolded" on-site in order to reduce labor need, time, and expense.
A need exists for a drilling rig that has less impact on the ground cover or foliage when being transported. A need also exists for less impact on the ground when the drilling rig is set up and in use.
A need also exists for a drilling rig that can be used as a land drilling rig and by assembling the components in a different manner can also be used as an offshore drilling rig.
The present embodiments meet these needs.

BRIEF DESCRIPTION OF THE DRAWINGS
The detailed description will be better understood in conjunction with the accompanying drawings, wherein like reference characters represent like elements, as follows:
Figure 1 depicts a flow chart of an embodiment of a method to construct and transport a modular drilling.
Figure 2 depicts a side view of an embodiment of a transfigurable container.
Figure 3 depicts a side view of an embodiment of an unfolded transfigurable container.
Figure 4 depicts a side view of an embodiment of a transfigurable container acting as a support to drilling equipment.
Figure 5 examples a partial side view of an erected drilling rig made from a transfigurable container.

Figure 6 examples a partial top view of an erected rig made from a transfigurable container.

Figure 7 depicts a partial side view of an erected drilling rig shown in Figure 5, but in the limited footprint configuration for land of offshore use.

Figure 8 depicts a partial top view of an erected drilling rig shown in Figure 5 but in the limited footprint configuration for land of offshore use.

Figure 9 depicts a side view of a straddle carrier usable with the embodied systems.

Figure 10 depicts a top view of a straddle carrier and the manner of folding according to the embodied methods.

Figure 11 depicts a top view of a containerized straddle carrier and the manner of folding according to the embodied methods.

Figure 12a examples a step in a rig up sequence showing the erection of the drilling derrick or mast.

Figure 12b examples the next step in a rig up sequence showing the erection of the drilling derrick or mast.

Figure 12c examples the next step in a rig up sequence showing the erection of the drilling derrick or mast.

Figure 12d examples the next step in a rig up sequence showing the erection of the drilling derrick or mast.

Figure 12e examples the next step in a rig up sequence showing the erection of the drilling derrick or mast.

Figure 13a examples a step in a rig up sequence involving a BOP container.

Figure 13b examples the next step in a rig up sequence involving a BOP container.

Figure 13c examples the next step in a rig up sequence involving a BOP container.

The present method is detailed below with reference to the listed Figures.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

Before explaining the present method in detail, it is to be understood that the method is not limited to the particular embodiments and that it can be practiced or carried out in various ways.

The present embodiments save the environment by reducing the number of vessels that are required to ship a drilling rig to different locations around the world. The embodied methods reduce the amount of environmental impact on the earth caused by trucks, trains, or other types of land.
transportation. The reduction is accomplished by reducing the space required to transport the standard sized devices. The reduction is accomplished by reducing the space required to transport the standard sized devices. Once the rig has reached a drilling site, the surface area that is needed to setup and operate the drill rig is less than a comparable drilling rig not using the method. The reduction in area that must be cleared of trees for the embodied rig is approximately 1200m² versus approximately 2000m² on a comparable conventional drilling rig. The amount of area that must be cleared on the path to the drilling site is considerably less with a comparable drilling rig.

Since the individual weight of the transfigurable containers is less compared with a normal drilling rig, the load on the road is less severe. The lower weight enables easier transportation across less developed roads and makes the drilling rig easier to be used in less developed countries.

Since the embodied methods reduce the number of vessels needed to transport a drilling rig, the methods provide a reduction of fuel usage; a benefit to both cost and the environment. For example, a common sized drilling rig can be transported with seventeen containers. Other drilling rigs of a comparable size often cannot be broken down into container sized packages of less than seventeen. Usually the drilling rigs of a comparable size require containers and shipping parts doubling and tripling the number used with the embodied methods.

An embodiment of the transfigurable container of drilling equipment allows for two or more two pieces of drilling equipment with associated load bearing devices to be attached together using connectors, such as pivotable connectors. When pivotally connected together, the drilling equipment modules are transformable between an initial shipping container size and shape and a second size and shape. For example, the shipping container can be formed into a rectangular shape when transported and transformed into a non-rectangular shape when in operation. The ability to transform readily between these two sizes and shapes provides an operational drilling structure that can easily be transported and then erected on different locations and in different shapes depending on the operational demands.

With reference to the figures, Figure 1 depicts a flow chart of the steps in the creation of the transfigurable container. The method to construct and transport a modular drilling rig includes transporting drilling equipment in the form of a transfigurable container to a drilling site. One or more transfigurable shipping containers, usually of a standardized container size, are placed at a drilling location (Step 200). The method can also include a step of forming the standardized transfigurable shipping containers into a larger rectangular shape.

The transfigurable shipping containers are unfolded at the drilling location (Step 202). Two or more of the transfigurable shipping containers, now unfolded at the drilling site, are connected
to one another to operable drilling equipment (Step 204). The method can also include a step of forming a mast or derrick from the standardized transfigurable container.

After connecting the containers, the operable drilling equipment is erected into a drilling rig (Step 206). Erecting the drilling rig can include setting up the drill floor; a mast substructure; a mast; a control cabin, a drawworks; a blow out preventer (BOP); a choke and kill manifold; and a blow out preventer control unit. The method can include the step of coupling the drilling equipment to the load bearing supports or load bearing bottom with a moveable coupling selected from the group of, a rotatable coupling between the drilling equipment, a rotatable coupling between load supports, a rotatable coupling between one load bearing support and a load bearing bottom, a device for elevating the drilling equipment above one load bearing support or a load bearing bottom, and a container connector that removably connects the standardized transfigurable shipping containers together.

Piping and cabling for communication and power cabling are then installed on the drilling rig (Step 208). The drilling rig is then in condition to begin operations (Step 210).

Figure 2 examples attaching the drilling equipment to either a load bearing support or a load bearing bottom with telescoping, rotatable connectors or with pivotable, rotatable connectors. A transfigurable container (10) can be attached to the first load bearing support (14), the second load bearing support (16), or the load bearing bottom (18). The drilling equipment can be attached to either load bearing support (14 and 16) or load bearing bottom (18) using telescoping, rotatable connectors or pivotable, rotatable connectors, sliding connectors, or non-rotating telescoping connectors.

The transfigurable container (10) can be a component of a modular drilling rig. The transfigurable container (10) can include a first and second load support (14 and 16) and a load bearing bottom (18). The first and second load bearing supports (14 and 16) can be positioned to form a mast or a derrick. The load bearing bottom (18) is located between the first and second load bearing supports (14 and 16), thereby forming a space (20). The load bearing bottom (18) can have a lattice construction or be a load-bearing plate.

Figure 3 depicts a side view of an unfolded transfigurable container. Figure 3 shows examples of drilling equipment attached to the loading bearing structure. A rotatable coupling (68) can be used between the drilling equipment. A rotatable coupling (70) can be between the load supports. A rotatable coupling (not shown) can be used between one of the load-bearing supports and the load bearing bottom.

Figure 4 depicts an embodiment of a device for elevating the drilling equipment (74) above
one of the load bearing supports or load bearing bottom. In particular, Figure 4 examples the second load support (16) and the load bearing bottom (18) supporting various pieces of solids control equipment (50a, 50b, 50c, 50d, 50e, and 50f). In an alternative embodiment, a device for elevating the drilling equipment (74) can be used rather than a cranage device.

The drilling equipment is preferably located within the space between the first and second load bearing supports. The drilling equipment can be attached together and movable from the space to create an operational position outside of the transfigurable container.

Figure 5 examples the drilling equipment erected from the transfigurable container in the offshore embodiment. The drilling equipment can include a mast (24), a control cabin (30), a drawworks module (32), a choke and kill manifold (36), active mud tank (102), and a BOP control unit (38), not shown. Other types of drilling equipment include a winch (40), a crown block (42), a top drive (44), a rotary table (not shown), piece of solids control equipment (50a), a second load support (16), a power source (52), a hydraulic power unit (54), a tank (56), electrical control equipment, a pipe rack, a crane (91), a traveling block (66), a container connector (76) and combinations thereof. The drilling equipment can further include a deck or supporting structure (5) of an offshore platform.

Figure 6 examples the drilling equipment erected from the transfigurable container in a land embodiment. The drilling equipment can include a casing (9), such as drill pipe, a drill collar, and bottom hole assembly (BHA). The drilling equipment can include a mast (24), a drill floor (26), a mast substructure (28), a drawworks (32), a blow out preventer (BOP) (34), a choke and kill manifold (36), a well head (106), and a BOP control unit (not shown). Other examples of drilling equipment include a winch (40), a second load support (16), a crown block (42), a top drive (44), a rotary table, electrical control equipment, a pipe rack, pipe handling equipment (62), a crane (91), a traveling block (66) and combinations thereof.

Figure 7 examples drilling equipment that can be included inside of a transfigurable container (11). For example, Figure 7 shows a control cabin (30), a mud pump (48a), a mud tank (56), electrical control equipment, a pipe rack, pipe handling equipment and combinations thereof. The shipping containers can be assembled to create a mast or derrick.

Transfigurable containers for the drilling equipment are transformed to form a portion of an operable drilling rig or standardized shipping containers. The transfigurable containers can be compliant with ISO standards.

Typical sizes for standardized shipping containers include overall lengths ranging from about 8 feet to about 64 feet, overall widths ranging from about 2 feet to about 15 feet, and overall heights
ranging from about 2 feet to about 15 feet. An example dimension for a transfigurable container is
an overall width of 8 feet, an overall height of 9.5 feet, and an overall length of 45 feet, 40 feet, or
20 feet.

Figure 8 examples how a containerized straddle carrier can fold inside a transfigurable
shipping container. The transfigurable shipping containers can include containerized straddle
carriers (119) that are adapted to fold inside a standard shipping container. The containerized
straddle carrier (119) with a transfigurable container (11) can be transported by a truck (150). Figure
8 depicts the truck (150), but only two wheels (170 and 171) and two frames (163 and 164)
associated with containerized straddle carrier (119) are shown.

Another embodiment is a modular transfigurable drilling rig. The drilling rig can be
configured as an offshore oil or natural gas drilling rig or as a land-based oil or natural gas drilling
rig. The drilling rigs can be configured for use on a semisubmersible, a tension leg platform, a jack
up platform, or another floating vessel. The drilling rigs can be configured for use on a fixed
offshore platform, such as a gravity based platform, compliant tower or any other offshore platform
that is standing on the seafloor. The modular transfigurable drilling rig can be made from numerous
transfigurable containers for drilling equipment.

The standardized transfigurable containers can be stacked on skid beams to present a small
footprint. Alternatively, the transfigurable containers can be stacked on top of each other to present
a very small footprint. The small footprint is useful for offshore platforms and jungle pads.

Figure 9 depicts a top view of an embodiment of a modular drilling rig. Figure 9 depicts an
example of the transfigurable container (11) with other types of equipment on the drilling rig.
Figure 9 examples locations of the drawworks (32), a rotary table (46), a piece of solids control
equipment (50b), a power source (52), a tank (56), pipe handling equipment (62), with casing (9),
piping (80), a mud tank (102) and a second load support (16). The equipment is supported by a
drilling rig (floating or fixed) (5). The transfigurable containers can be lifted on board the drilling
rig using a crane available on the drilling rigs.

The transfigurable containers (11), after being unfolded, are connected to form an operational
modular drilling rig. In another embodiment, the drilling rig can be partially formed from the
transfigurable containers and other drilling equipment.

The container connectors can be a load bearing device or a non-load bearing device.
Examples of the container connectors used as a load bearing device include pins, hydraulic clamps,
mechanical clamps, threaded connectors, male receptacles, female receptacles, and combinations
thereof. Examples of the container connectors used as a non-load bearing device include threaded
connectors, plugs, hydraulic clamps, mechanical clamps, pins, male and female receptacles, and combinations thereof.

Piping can be used to connect the drilling equipment together. Cabling can be used with the drilling rig to provide communication and/or electrical power between the drilling equipment. A power source is typically connected to the drilling equipment to provide power to the drilling equipment.

Figure 10 depicts a top view of a constructed modular rig using the transfigurable containers and the embodied methods. The methods entail transporting numerous standardized transfigurable shipping containers with drilling equipment to a drilling location. The standardized transfigurable shipping containers with the drilling equipment are unfolded at the drilling location. Two or more of the unfolded transfigurable containers are connected together to form operable drilling equipment and an operable drilling rig. Typically, as shown in Figure 9, the drilling equipment includes a control cabin (30), a drawworks (32), a BOP control unit (38), a rotary table (46), various pumps (48a and 48b), solids control equipment (50a, 50b, and 50c), power sources (52a and 52b), hydraulic power units (54a, and 54b), a tank (56), electrical control equipment (58), a pipe rack (60), a mud pit (100), an active mud tank (102), and other such equipment. The connected equipment is erected with piping (78, 80, and 82) and cabling (84, 86, and 88) for communication and power cabling for complete operation.

Figure 11 depicts a top view of a containerized straddle carrier (119) and the manner of folding according to the embodied methods. The straddle carrier (119) comprises four wheels (two are identified, 170 and 171) that are movably attached to a frame (161, 162, 163, and 164). The lifting section of the frame is fixably connected to a support section of the frame. The support section of the frame is of the size of a standard size shipping container, preferably an ISO standardized container. The spreader section of the frame is temporarily to the support section. The spreader section connects to the load to be lifted. The lifting section can move the support section in a vertical direction to pick up loads from and to container carriers. The wheels (two are identified, 170 and 171) can be folded upwards when the straddle carrier "transforms" to a transportable size. The folding direction of the wheels (two are identified, 170 and 171) is depicted in Figure 11 by the arrows (A, B, C, and D).

Figures 12a though 12e provide an example an embodiment of a rig up procedure for the embodied drilling rig. The procedure begins by moving two transfigurable containers together. Figures 12a though 12e provide an example a base container and a mast or derrick container. After the containers are connected, hoisting means, which are part of base container, are rotated out.
towards the mast or derrick container and then connected to the mast or derrick container. The mast container is rotated into vertical position and finally locked in place.

Figures 13a through 13c provide an example a rig up sequence involving a BOP container (216). The BOP container (216) is moved towards base container (210) and connected to base container (210). After connection is complete, the BOP container (216) is rotated into vertical position. The rotation can be done using various hoisting means (not shown). The BOP container (216) with the drill floor is locked firmly in place with the other containers.

The embodiments have been described in detail with particular reference to certain preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the scope of the embodiments, especially to those skilled in the art.
CLAIMS

1. A modular transfigurable drilling rig comprising:
   a. a transfigurable container adapted to form an operational drilling rig, wherein the
      transfigurable container comprises:
      i. a load bearing structure comprising a first load bearing support, a second
         load bearing support, and a load bearing bottom, wherein the load bearing
         bottom is disposed between the first and the second load bearing supports,
         thereby forming a space; and
      ii. drilling equipment connected to the load bearing structure;
      iii. a connector adapted to engage at least two transfigurable containers;
   b. piping adapted to connect the drilling equipment together;
   c. cabling adapted to provide communication between the drilling equipment; and
   d. a power source connected to the drilling equipment, wherein the power source is
      adapted to provide power to the drilling equipment.

2. The modular transfigurable drilling rig of claim 1, wherein the drilling equipment is movable
   between a first position disposed within the space and a second position disposed outside the
   space.

3. The modular transfigurable drilling rig of claim 1, wherein at least two transfigurable
   containers are stacked to present a small footprint for the modular transfigurable drilling rig.

4. The modular transfigurable drilling rig of claim 1, further comprising a crane, wherein the
   crane is mounted on top of a mast or derrick and is used to construct the modular
   transfigurable drilling rig.

5. The modular transfigurable drilling rig of claim 4, wherein the crane is remotely controlled.

6. The modular transfigurable drilling rig of claim 4, wherein the crane folds inside a second
   transfigurable container.

7. The modular transfigurable drilling rig of claim 1, wherein the modular transfigurable
   drilling rig is configured for use as a land based oil drilling rig or natural gas drilling rig.

8. The modular transfigurable drilling rig of claim 7, wherein the modular transfigurable
   drilling rig is configured for use on a semi-submersible, a tension leg platform, a jack up
   platform, a floating vessel, or combinations thereof.

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9. The modular transfigurable drilling rig of claim 7, wherein the modular transfigurable drilling rig is configured for use on a fixed oilfield offshore platform, wherein the fixed oilfield offshore platform is selected from the group consisting of a jacket, a production platform, a compliant tower platform, and a platform supported by a seabed.

10. The modular transfigurable drilling rig of claim 1, wherein the connector is a load bearing device.

11. The modular transfigurable drilling rig of claim 10, wherein the load bearing device is selected from the group consisting of a pin, a hydraulic clamp, a mechanical clamp, a threaded connector, a male and female receptacle, and combinations thereof.

12. The modular transfigurable drilling rig of claim 1, wherein the connector is a non-load bearing device.

13. The modular transfigurable drilling rig of claim 12, wherein the non-load bearing device is selected from the group consisting of a threaded connector, a plug, a hydraulic clamp, a mechanical clamp, a pin, a male and female receptacle, and combinations thereof.

14. The modular transfigurable drilling rig of claim 1, wherein the modular transfigurable drilling rig is partially formed from transfigurable containers and other drilling equipment.

15. The modular transfigurable drilling rig of claim 1, wherein the transfigurable container is a containerized straddle carrier adapted to fold inside a standard shipping container and to be transported as the standard shipping container.

16. The modular transfigurable drilling rig of claim 1, wherein the transfigurable container further comprises a BOP, wherein the BOP is tested while inside the space.

17. A method to construct and transport a modular drilling rig, wherein the method comprises the steps of:
   a. transporting a transfigurable container comprising drilling equipment to a drilling location;
   b. unfolding the transfigurable container at the drilling location, thereby forming an unfolded transfigurable container;
   c. connecting at least two unfolded transfigurable containers and the drilling equipment to form the module drilling rig;
   d. erecting the modular drilling rig at the drilling location;
   e. connecting piping and cabling for communication and power cabling to the drilling equipment on the modular drilling rig; and
   f. operating the modular drilling rig.
18. The method of claim 17, further comprising the step of stacking two or more transfigurable containers to present a small footprint for the modular drilling rig.

19. The method of claim 17, wherein the transfigurable container is compliant with ISO standards.

20. The method of claim 17, further comprising the step of adapting a containerized straddle carrier to fold inside the transfigurable container.

21. The method of claim 17, further comprising the step of coupling the drilling equipment to a load bearing support or a load bearing bottom with a moveable coupling, wherein the moveable coupling is selected from the group consisting of:
   a. a rotatable coupling between the drilling equipment;
   b. a rotatable coupling between two or more load supports;
   c. a device for elevating the drilling equipment above the load bearing support or the load bearing bottom; and
   d. a container connector that removably connects at least two transfigurable shipping containers together.

22. The method of claim 17, wherein the transfigurable container is lifted on an offshore platform using a crane that is available on the offshore platform.

23. The method of claim 22, wherein the offshore platform is a selected from the group consisting of a gravity based platform, a compliant tower, and a platform connected to the seafloor.
FIGURE 1

Transporting

Unfolding

Connecting Containers

Erecting

Connecting Piping

Operating