

A mine storage and handling unit

BACKGROUND OF THE INVENTION

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The current invention concerns arrangements for handling of mines.

Sea mines are typically large, weighing several hundreds of kilograms. They may contain large amounts of high explosives, typically in the range of several tens of kilograms to a hundred kilograms or even more. Since they are both heavy and dangerous, their handling requires care throughout the supply and loading chain, and on the mining vessel itself.

A typical arrangement for handling mines on mine-laying vessels include tracks and sleds, on which mines are placed. The sleds allow movement along the tracks, and typically are constructed so that the sleds cannot move perpendicularly to the tracks, i.e. removing the possibility of the sled and mine falling off a track during heavy seas. When a mine is laid, it is rolled on it sled off the tracks past the stern of the vessel and into the sea. The sled is typically allowed to fall as well. The sled may be used as a part of the mine system, for example as an anchor. The sled may also be a sacrificial component that is not used for any further purpose nor recovered.

Mine laying ships are often dedicated ships built only for this purpose. The tracks and the space required for the tracks make it difficult to use a mine laying ship for other purposes, and conversely, ships built for other purposes do not typically have tracks for mines. Maintaining the ability to lay minefields therefore practically requires that a navy dedicates a number of ships to mine laying functions. However, acquiring such ships is expensive, as is the upkeep of such ships.

These current arrangements for handling mines also require a harbor to have corresponding systems for handling and loading mines, in order to be able to supply and load mines on mine laying vessels. This requirement of special mine handling systems also limit the possibilities of arranging mine supplying and loading operations in different locations, as a generic harbour without specific equipment cannot be used.

Some systems aimed at more modular approach are known. For example, the patent application document GB2253189A discloses a system that is based on a trailer,

that has an incorporated crane and that is loaded with mines. In use the trailer is driven onto a ship and the mines are unloaded over the side of the ship with the crane. This system allows the use of a wide variety of ships to lay mines. However, this system requires that the trailer is located close to the sides of the ship, so that
5 the crane can reach over the side, which limits the number of mines that can be loaded on a ship using this system. Further, this system relies on the functioning condition of the crane, which may be unreliable in bad conditions. Further, unloading mines using a crane is difficult in heavy seas.

10 Another solution is disclosed in patent document US4633778A, which describes a system built from ganged modules that can be installed on many different types of ships. That minelaying system is a modularized overhead conveyor system. However, while this system makes actual laying of mines easier, this system does not improve the actual loading of the mines on the ship and into the conveyor
15 system.

Another solution is disclosed in patent document US6082266, which describes a high speed air cushion vehicle transporting mines stacked on a mine laying rack, that is longitudinally displaceable on rails.
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SUMMARY OF THE INVENTION

25 An object of the invention is to realize a way to handle mines, that overcomes the problems of prior art. Moreover, an object of the invention is to provide a way to handle mines that allows for supplying and loading of mines in harbors, that do not have dedicated mine handling equipment. A still further object of the invention is to provide a way to handle mines that allows many different kinds of ships to be used for laying mines.

30 The objects are reached by creating a mine handling and storage unit, which can be moved and loaded using standard cargo transport containers, such as multimodal shipping containers, and which unit comprises at least one pair of tracks onto which mine sleds and mines can be placed. Such a unit may also preferably comprise
35 connector track elements for connecting a piece of track in one unit to a piece of track in another unit, allowing easy movement of mines and mine sleds along a number of units arranged beside each other. Such a unit may also in various embodiments of the invention comprise many other different elements, as described

further in this specification. Such a unit allows for easy handling and loading of mines on a vessel.

5 The mine storage unit according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a mine storage unit.

The dependent claims describe further advantageous embodiments of the invention.

10 The above summary relates to only one of the many embodiments of the invention disclosed herein and is not intended to limit the scope of the invention, which is set forth in the claims herein. These and other features of the present invention will be described in more detail below in the detailed description of the invention and in conjunction with the following figures.

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BRIEF DESCRIPTION OF THE DRAWINGS

Various embodiments of the invention will be described in detail below, by way of example only, with reference to the accompanying drawings, of which

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Figure 1 illustrates a mine storage unit according to an advantageous embodiment of the invention,

25 Figure 2 illustrates a number of mine storage units attached to a vessel and connected to each other for providing a mine laying system,

Figure 3a illustrates certain curved track arrangements according to further advantageous embodiments of the invention, and

30 Figure 3b illustrates certain track and door arrangements according to further advantageous embodiments of the invention.

Same reference numerals are used for similar entities in the figures.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An advantageous embodiment of the invention is illustrated in figure 1, which shows a conceptual side view of a mine storage unit 100. The mine storage unit
5 comprises at least one pair of tracks 110. These tracks are in the unit 100 for attachment of mine sleds 120 and mines 130.

The width of a pair of tracks as well as the shape of each track may be different in different embodiments of the invention. As a man skilled in the art knows, there are
10 different types of tracks in use by navies of different countries. This invention is not limited to any specific type of track, and therefore, these different track types well known to a man skilled in the art are not described any further in this specification.

In a further advantageous embodiment of the invention, the mine storage unit
15 comprises two pairs of tracks for attachment of mines and mine sleds.

Further, the mine sleds 120 are depicted here only conceptually, since the invention is not limited to any specific type or types of mine sleds. Constructional details of such mine sleds depend on the structure of the tracks 110, as well as the structure of
20 mines 130 and any fastening mechanisms needed to fasten mines 130 to the sleds 120. Many different types of sleds, mines, and fastening systems are known to a man skilled in the art, and are therefore not described any further in this specification.

Figure 1 also illustrates certain elements present in various further embodiments of the invention. In the example of figure 1, the mine storage unit 100 also comprises a mine laying track element 240. In the example of figure 1, the mine laying track element is attached to the tracks 110 by hinges. Other possibilities and solutions for mine laying track elements are described later in this specification.
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Figure 1 illustrates also a connector track element 220. In the example of figure 1, the connector track element is attached to the tracks 110 by hinges. Other possibilities and solutions for connector track elements are described later in this specification.
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Figure 1 illustrates also corner fittings 140. In an advantageous embodiment of the invention, the mine storage unit 100 has such dimensions and corner fittings that allow standard intermodal container (also known as an ISO container) handling
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machinery such as reach stackers to handle such mine storage units. One standard describing such corner fittings is the ISO 1161 standard, which determines a so called twistlock structure that is commonly used for attaching a container to a lifting device, to a vessel, or to another container. In an advantageous embodiment of the invention, the corner fittings 140 have a construction, that allows the mine storage unit 100 be lifted, transported, and attached by mechanisms intended to lift, transport, and/or attach containers adhering to the ISO 1161 standard.

In a further advantageous embodiment of the invention, the corner fittings are constructed so as to conform to the ISO 1161 standard.

In a further advantageous embodiment of the invention, only a part of the corners of the unit have corner fittings. For example, a mine storage unit having corner fittings only at the four bottom corners, could still be attached to a transport vehicle or on the deck of a ship.

In various other embodiments of the invention, the mine storage unit can be realized with different sizes and attachments than those which are specified by the standards ISO 668, ISO 1161, and other related standards. Such an embodiment would provide many of the advantages described in this specification, and would thus be a feasible way to implement the invention. For example, in a further embodiment of the invention, a mine storage unit can be dimensioned and fitted with attachments for aerial transport. In a further advantageous embodiment of the invention, a mine storage unit can be dimensioned and fitted with attachment points for handling with forklifts.

The inventive mine storage units provide numerous advantages for handling mines. The mine storage units can be used for transporting mines to harbours, for storage of mines at storage depots or harbours, for storage of mines on vessels, as well as for laying mines from a vessel. A mine storage unit protects the mines throughout the whole supply chain, and also while on the vessel.

The mine storage units can be realized for example with any common dimensions used for standard multimodal containers. For example, standard twenty foot equivalent (TEU) containers are commonly used in maritime but also land transportation. Mine storage units can advantageously be realized in the same twenty foot long dimensions, whereby such mine storage units can be moved and handled using any common container handling machines. This allows easy

transportation of mines on common types of road and rail transport, as well as easy handling in storage depots and harbors. Further, common multimodal container lengths include 40 foot containers, and 45 and even 48 foot containers are in use. Inventive mine storage units can advantageously be implemented in any of these sizes.

A mine storage unit needs to have at least one side with an opening such as a door for moving mine sleds and mines in and out of the mine storage unit. For example, in an advantageous embodiment of the invention, a similar solution is used as in conventional multimodal containers, namely a set of two doors at one end of the container.

In a further advantageous embodiment of the invention, two ends of the mine storage unit have doors that can be opened in order to allow movement of mine sleds and mines in and out of the unit.

The doors can be implemented in many different ways. For example, the doors can be similar in construction as in a typical multimodal container.

In a further advantageous embodiment of the invention, the doors are attached removably to the unit. This type of construction allows the doors to be removed and stored in another place so as not to be in the way when working with the mines and mine sleds.

In a further advantageous embodiment of the invention, a door is constructed with such hinges that allow turning of the door through roughly 270 degrees, allowing the door to be pushed against the side of the mine storage unit.

In a still further advantageous embodiment of the invention, the door may be constructed as a lifting door, that moves inside the mine storage unit.

Many other door constructions can also be used in various further embodiments of the invention.

In a further advantageous embodiment of the invention, the mine storage unit further comprises at least one movable connector track element for connecting tracks between two mine storage units, when the mine storage units are placed one after another e.g. on a vessel. Such a structure allows creation of a contiguous track

from more than one mine storage unit, allowing all mine sleds and mines to be moved out of the mine storage units.

5 The connector track elements may be constructed in many different ways. A connector track element may comprise for example a single piece of track, two of which are manually installed between a pair of tracks in a first mine storage unit and a pair of tracks in a second mine storage unit. A connector track element can also be implemented as a suitable length of a pair of tracks. In such embodiments of the invention where the mine storage unit comprises two pairs of tracks, a connector
10 track element can advantageously comprise a length of two pairs of tracks.

A movable connector track element can be attached to the mine storage unit in many different ways. For example, the connector track element can be stored inside the mine storage unit, from where it can be manually detached and installed
15 between tracks of two mine storage units. In a further advantageous embodiment of the invention, the connector track element is attached to tracks in the mine storage unit by hinges, which allow the connector track element to be simply lowered into position between the two units. Different sliding and telescoping structures can also be used. Any other mechanisms for removably installing a connector track element
20 between tracks of two mine storage units can also be used in different embodiments of the invention.

In a further advantageous embodiment of the invention, the mine storage unit further comprises at least one mine laying track element for allowing a mine to be
25 laid by rolling the mine on its mine sled over said at least one mine laying track element to the body of water being mined.

The mine laying track elements may be constructed in many different ways. A mine laying track element may comprise for example a single piece of track, two of
30 which are manually connected to the end of tracks in a mine storage unit, or to the end of another mine laying track element. A mine laying track element can also be implemented as a suitable length of a pair of tracks. In such embodiments of the invention where the mine storage unit comprises two pairs of tracks, a mine laying track element can advantageously comprise a length of two pairs of tracks.

35 A mine laying track element can be attached to the mine storage unit in many different ways. For example, the mine laying track element can be stored inside the mine storage unit, from where it can be manually detached and installed to the end

of a track in the mine storage unit. In a further advantageous embodiment of the invention, the mine laying track element is attached to tracks in the mine storage unit by hinges, which allow the mine laying track element to be simply lowered into position. Different sliding and telescoping structures can also be used. Any other mechanisms for removably installing a mine laying track element can also be used in different embodiments of the invention.

The mine laying track element needs to be long enough to allow mines to be dropped off the vessel. The necessary length depends on the shape and structure of the particular vessel used for laying mines, and how close to the edge of the deck of the ship a mine storage unit can be installed. In a further advantageous embodiment of the invention, a mine storage unit can comprise a plurality of mine laying track elements, of which a sufficient number can be connected together to provide a sufficient length of track for dropping a mine off the edge of the deck of the ship.

Figure 2 illustrates an arrangement of mine storage units 100 on a deck of a ship 200. Figure 2 illustrates schematically only the stern of the ship. Figure 2 shows four mine storage units 100, each of which contains two pairs of tracks 110, mine sleds 120 and mines 130. Figure 2 is only schematic in nature for explaining certain features of inventive embodiments, and not dimensionally or otherwise accurate. Figure 2 illustrates mine laying track elements 240a, 240b connected to the end of mine storage units 100 closest to the stern of the ship 200. Figure 2 illustrates two variations in the structure of mine laying track elements: an example of a mine laying track element 240a having two pairs of tracks 110b, and an example of a one-track-wide mine laying element 240b having one pair of tracks 110b.

Figure 2 also illustrates connector track elements 220a, 220b. As described previously in this specification, these connector track elements are used to join tracks 110 within consecutively located mine storage units 100. Figure 2 illustrates two variations in the structure of connector track elements: an example of a connector track element 220a having two pairs of tracks 110b, and an example of a one-track-wide connector track element 220b having one pair of tracks 110b.

In a further advantageous embodiment of the invention, different configurations of mine storage units can be loaded onto a vessel. For example, if a vessel has deck space for a plurality of mine storage units chained end-to-end, a mine storage unit having at least one mine laying track element can advantageously be loaded and attached close to the edge of the deck, and a mine laying track is arranged from said

at least one mine laying track element to allow mines and mine sleds to be rolled from the mine storage unit over the edge of the deck. The rest of the plurality of mine storage units installed in the same chain of mine storage units can then be mine storage units without mine laying track elements, as they only need to be
5 connected to the next mine storage units using connector track elements.

In a further advantageous embodiment of the invention, a mine laying track element is provided separately from a mine storage unit to a vessel. This arrangement may be advantageous especially in cases, in which the mine laying track element needs
10 to be shaped in a specific ways in order to be securely installable on the vessel.

In a further advantageous embodiment of the invention, at least one side wall of the mine storage unit is arranged to be openable in order to allow access to mines inside the mine storage unit. Such an embodiment is useful for allowing servicing of the
15 mines, or for example for preparing the mines and their fuses for dropping the mines into the body of water being mined. Depending of the size of the particular mines, there may be not a lot of free space within the mine storage unit, whereby having an openable wall allows easier access to the mines. An openable side wall also allows the mines and mine sleds to be moved into or out of the mine storage
20 unit through the side wall.

The openable wall can be implemented in many different ways. For example, the mine storage unit can comprise one or more doors with hinges, or sliding doors. Further, the mine storage unit can for example comprise a fabric door that can be
25 slid aside or rolled up. Further, a whole side wall can be composed of fabric or other flexible material, which can easily be detached, moved aside or rolled up. Any other openable side wall structure, many of which are known to a man skilled in the art of multimodal container solutions, can also be used.

30 In a further advantageous embodiment of the invention, a mine storage unit comprises at least one pair of curved tracks. Such curved tracks can be used to move a mine sled from one straight pair of tracks to another, or for example to create a 90 degree turn in a track for moving mine sleds in and out of the mine storage unit through a side wall of the unit.

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In a further advantageous embodiment of the invention, a mine storage unit comprises at least one track switching element for creating selectable routes for mine sleds.

Figure 3a illustrates schematically certain curved track arrangements according to further advantageous embodiments of the invention. Figure 3a shows a schematic view of an example of a track arrangement in a mine storage unit 100. In this example, the mine storage unit comprises a pair of curved tracks 110d, allowing movement of a mine sled and a mine from one pair of longitudinal tracks 100 to another. Many different types of curved track arrangements, track switches and other track arrangements are known from the rail transport industry, and can be used in different combinations in mine storage unit in order to provide maneuverability for the mine sleds.

In a further advantageous embodiment of the invention, a mine storage unit comprises a rotating track element. Such a rotating track element can be used to move a mine sled sideways e.g. to another track or through the side wall of a mine storage unit. A mine sled can be rolled onto the rotating track element, whereafter the rotating track element can be rotated 90 degrees, allowing the mine sled to be moved sideways in respect of the original track where the mine sled was previously located.

Figure 3b illustrates certain track and door arrangements according to further advantageous embodiments of the invention. Figure 3b illustrates a track element 110c installed on a rotating element 310, thus providing a rotating track element 310, 110c. A rotating track element makes it possible to move a mine sled 120 with a mine 130 on the rotating track element while the tracks 110c of the rotating track element are aligned with tracks 110 of the mine storage unit 100, and then rotate the rotating track element 90 degrees, after which the sled 120 and mine 130 on the rotating track element can be moved perpendicular to the direction of the tracks 110 of the mine storage unit 100. Figure 3b illustrates two rotating track elements 310, 110c momentarily in the 90 degree rotated position. With two rotating track elements as shown in figure 3b, a mine sled and a mine can be transferred from one pair of tracks within the mine storage unit 100 to another pair of tracks in the mine storage unit. Figure 3b also illustrates side walls 101 of the mine storage unit 100, and an opening 102 in a side wall. This opening 102 can be used for transporting mine sleds and mines into and out of the mine storage unit 100 through its side wall 101. This opening 102 can also be used for accessing the mines e.g. for maintenance of a mine or for setting the mine ready to be deployed.

In a further advantageous embodiment, a mine storage unit comprises a U-shaped pair of tracks for allowing movement of a mine sled from one longitudinal section of track of the mine storage unit to another.

- 5 In a still further advantageous embodiment of the invention, a mine storage unit comprises a section of a pair of tracks, that are installed on a sliding mechanism allowing sliding of said section of a pair of tracks from one side of the mine storage unit to another. Such a mechanism can be used for moving mine sleds and mines from one track to another.

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In an even further advantageous embodiment of the invention, a mine storage unit comprises a winch arrangement in order to move mines and/or mine sleds from one pair of rails to another within the mine storage unit.

- 15 In a further advantageous embodiment of the invention, a mine storage unit is installed onto a wheeled base such as a trailer, whereby the mine storage unit can be easily transported on land and loaded onto a ship. A mine laying system can in such an embodiment be provided using mine storage units arranged end to end on their wheeled bases, and connected with connector track elements.

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The invention has numerous advantages. The invention provides a modular container packaged minelaying system, which can be deployed for minelaying purposes on any naval vessel having container compatible mission deck and a stern gate operable at sea. This system enables the design of new naval vessels which can
25 have minelaying capability as just one of their several mission modules, without dedicating the vessel primarily as a minelayer.

- Further, a conventional mine laying ship typically has a fixed set of tracks, which allows operations with only such mines that can be attached to such sleds that match
30 the tracks of the ship. Since there are different mine types with very different measurements and other properties, the fixed tracks limit the potential selection of mines that can be carried by that ship. However, the inventive mine storage unit provides a way for ships to operate with almost any kind of mines, since the tracks are loaded onto the ship along with the mines as a part of the mine storage unit
35 arrangement.

Traditionally the purpose of minelaying has dominated the naval ship design of minelayers, compromising other possible mission designations to minor

transportation tasks. From technical perspective, the current invention reduces this domination to a minor requirement for the vessel to be able to receive multimodal containers, which capability can be used for many other purposes as well.

5 Furthermore, the container packaged minelaying system redefines other forms of required logistics to deploy sea mines as a major weapon system. Previously there has been need for specifically dedicated ports with permanently installed mine rails in order to load mines on minelayers. This invention enables every port with sufficient container handling capacity to serve this purpose. Also land based
10 transportation to feed the loading ports becomes trivial, since ordinary trucks are a common way to transport multimodal containers.

Furthermore, the invention also improves operational secrecy and security. Installing the mines system into a container that outwardly looks similar to a
15 standard shipping container allows the mines to be moved and stored in the same way as any usual commercial container, which in turn makes it difficult for adversaries and their informants to follow operational activities of the navy.

The invention allows the use of many different ships as a mine laying vessel, as
20 long as the vessel can accommodate containers on a deck and has at least an openable gate or door on the deck - or a deck with no railings. For example, the current invention allows the use of a conventional car ferry as a mine laying vessel.

25 CERTAIN FURTHER ASPECTS OF THE INVENTION

According to a first aspect of the invention, a mine storage unit is provided. In a first advantageous embodiment of this first aspect of the invention, the mine storage unit comprises at least a container for storing mines, and a pair of tracks inside said
30 container for attachment of mines and mine sleds.

In a further advantageous embodiment according to this first aspect of the invention said mine storage unit has a plurality of corner fittings suitable for handling by equipment, that are able to handle containers conforming to the ISO 1161 standard.
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In a further advantageous embodiment according to this first aspect of the invention the mine storage unit has a plurality corner fittings conforming to the ISO 1161 standard.

In a further advantageous embodiment according to this first aspect of the invention the mine storage unit has at least two faces that can be opened for transport of mines and mine sleds.

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In a further advantageous embodiment according to this first aspect of the invention the mine storage unit further comprises at least one movable connector track element for connecting tracks between two mine storage units

- 10 In a further advantageous embodiment according to this first aspect of the invention the mine storage unit comprises two pairs of tracks for attachment of mines and mine sleds.

- 15 In a further advantageous embodiment according to this first aspect of the invention the mine storage unit further comprises at least one mine laying track element for allowing a mine to be laid into a body of water by rolling the mine on its mine sled over said at least one mine laying track element to the body of water.

- 20 In a further advantageous embodiment according to this first aspect of the invention the mine storage unit comprises at least one openable side wall.

In a further advantageous embodiment according to this first aspect of the invention the mine storage unit further comprises a plurality of mine sleds.

- 25 In a further advantageous embodiment according to this first aspect of the invention the mine storage unit further comprises a plurality of mines.

- 30 In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention. While a preferred embodiment of the invention has been described in detail, it should be apparent that many modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention.

Claims

1. A mine storage unit, **characterized in that** the mine storage unit comprises at least
5 a container for storing mines, and

a pair of tracks (110) inside said container (100) for attachment of mines (130) and mine sleds (120).
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2. A mine storage unit according to claim 1, **characterized in that** the mine storage unit has a plurality of corner fittings (140) suitable for handling by equipment, that are able to handle containers conforming to the ISO 1161 standard.
- 15 3. A mine storage unit according to claim 1, **characterized in that** the mine storage unit has a plurality of corner fittings (140) conforming to the ISO 1161 standard.
4. A mine storage unit according to claim 1, **characterized in that** the mine storage unit has at least two faces that can be opened for transport of mines and mine sleds.
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5. A mine storage unit according to claim 1, **characterized in that** the mine storage unit further comprises at least one movable connector track element (220) for connecting tracks between two mine storage units
- 25 6. A mine storage unit according to claim 1, **characterized in that** the mine storage unit comprises two pairs of tracks (110) for attachment of mines (130) and mine sleds (120).
7. A mine storage unit according to claim 1, **characterized in that**
30 the mine storage unit further comprises at least one mine laying track element (240) for allowing a mine to be laid into a body of water by rolling the mine on its mine sled over said at least one mine laying track element to the body of water.
8. A mine storage unit according to claim 1, **characterized in that**
35 the mine storage unit comprises at least one openable side wall.
9. A mine storage unit according to claim 1, **characterized in that** the mine storage unit further comprises a plurality of mine sleds (120).

10. A mine storage unit according to claim 1, **characterized in that** the mine storage unit further comprises a plurality of mines (130).