

Compactor

FIELD OF INVENTION

5

The present invention relates broadly to a trash compactor and a method of collecting material for a trash compactor.

10 BACKGROUND

The collection of seaborne garbage from ships moored in ports and anchorages is typically carried out using open bins. The open bins are typically of dimensions of about 4.4m in length, about 2.4m in width and about 1.5m in height. However, using
15 open bins can create operational and environmental problems. The environmental problems can include an unpleasant smell and an unsightly appearance. Operational problems can include complications in transporting the open bins to land or from ships to smaller garbage collection harbour crafts.

20 As an alternative to open bins, the use of standard land-based mobile compactors installed on ships has been explored. The operation of such compactors is typically time-consuming because garbage has to be arranged in a queue and dumped sequentially into the compactors. Typically, a standard land-based mobile compactor is about 5.45m to 7.35m long and has a height of about 2.4m. The standard mobile land-
25 based compactor is typically made up of a compaction chamber of length varying from about 3.16m to about 5.06m and has a filling opening of length of about 0.9m by width of about 1.60m and height of about 1.2 m. The compaction chamber typically has a volume varying from about 10 cubic meters (m³) to about 16m³.

30 In addition, it has been recognised that if a standard land-based mobile compactor is used on a garbage collection harbour craft rather than on a ship itself, in order for the standard land-based compactor to be used for seaborne garbage

collection, a separate hopper has to be erected. This is to enable garbage bags thrown (or lowered) from a ship from a height of as much as 40m to be caught and guided to the relatively small filling opening of the compactor for compaction. The hopper has to be moveable so that it can be moved away when the compactor unit is full and lifted ashore for disposal of the garbage. However, it has been recognised that moving a hopper and removing a full compactor unit under the hopper is typically difficult and complicated.

Furthermore, for existing harbour crafts which are used to collect garbage using open bins of height of about 1.5m, standard land-based mobile compactors are not suitable to replace the open bins. As the compactors typically have a height of 2.4m, a standard land-based mobile compactor, together with a separate hopper necessary for the collection of seaborne garbage, when installed on such an existing harbour craft would obstruct the view from the wheelhouse making navigation of the craft more difficult. To overcome this difficulty, modifications to the existing craft, such as by lowering its deck or increasing the height of its wheelhouse, would be necessary. However, such modifications are typically expensive and not desired.

In view of the above problems, there exists a need for a trash compactor and a method of collecting material for a trash compactor that seek to address at least one of the above problems.

SUMMARY

In accordance with a first aspect of the present invention, there is provided a trash compactor comprising a material receiving surface coupled to a compaction chamber and disposed on the compaction chamber, the material receiving surface being inclined at an angle to the horizontal such that material collected on said surface is deposited into an entrance of the compaction chamber under gravitational force; and a compacting ram head wall disposed at an opposite end of the entrance from the material receiving surface to compact deposited material towards a direction of the inclination of the material receiving surface.

The material receiving surface may comprise extendable flaps for extending a surface area of said surface.

The angle may be in a range of about 20° to about 30°.

5 The trash compactor may be suitable for installation on a seaborne craft such that the installed trash compactor provides an unobstructed line of sight for an operator of said craft to view an area surrounding the craft from a wheel house of the craft.

10 The trash compactor may further comprise a compaction mechanism coupled to said compacting ram head wall and capable of exerting a compacting force within said compaction chamber.

The compaction mechanism may comprise an external hydraulic cylinder releasably coupled to said trash compactor.

15 The external hydraulic cylinder may be locked to a compactor wall and a piston of the external hydraulic cylinder is locked to the compacting ram head wall using a releasable locking mechanism.

20 The releasable locking mechanism may comprise a piston engaging member for engaging the piston.

25 The releasable locking mechanism may further comprise a lever connected to the piston engaging member, said lever being rotatable to move the piston engaging member between a released position and a locked position.

The piston engaging member may be moved between the released position and the locked position via a quarter turn of the lever.

30 The releasable locking mechanism may further comprise a biasing means for providing a biasing force to maintain the piston engaging member in the closed position.

The piston engaging member may comprise fork guides and a fork locking plate.

5 The trash compactor may comprise a ram box having a length not more than about 500mm.

10 In accordance with a second aspect of the present invention, there is provided a method of collecting material for a trash compactor, the method comprising the steps of providing a material receiving surface coupled to a compaction chamber, the material receiving surface being disposed on the compaction chamber, with said surface inclined at an angle to the horizontal; depositing material collected on said surface into a ram chamber entrance of the trash compactor under gravitational force; providing a compacting ram at an opposite end of the entrance from the material receiving surface; and compacting
15 the deposited material towards a direction of the inclination of the material receiving surface.

20 The method may further comprise installing said trash compactor on a seaborne craft.

BRIEF DESCRIPTION OF THE DRAWINGS

25 Embodiments of the invention will be better understood and readily apparent to one of ordinary skill in the art from the following written description, by way of example only, and in conjunction with the drawings, in which:

30 Figure 1(a) illustrates a schematic perspective view of a compactor having an internal compacting ram in an example embodiment;

Figure 1(b) illustrates an exploded perspective view of the compactor of Figure 1a showing the internal compacting ram;

35 Figure 2(a) illustrates a side view of the compactor of Figures 1a and 1b installed on a deck of a vessel/craft;

Figure 2(b) illustrates a top view of the compactor of Figure 2(a).

Figure 3(a) illustrates a perspective view of the compactor of Figures 1a-2b showing an external compacting ram;

5 Figure 3(b) illustrates a side view of the compactor of Figure 3a;

Figure 3(c) illustrates a top view of the compactor of Figures 3a and 3b;

10 Figure 3(d) illustrates a front view of the compactor of Figures 3a-3c;

Figure 4(a) illustrates a close-up side view of the compacting ram of Figures 3a-3d connected to the ram box of the compactor;

15 Figure 4(b) illustrates an exploded perspective view of the compacting ram of Figure 4a;

Figure 4(c) is a schematic perspective view of the assembled components illustrated in Figure 4(b).

20 Figure 5(a) illustrates a front view illustrating a quick release and locking mechanism of the compacting ram of Figures 4a and 4b.

25 Figure 5(b) illustrates an exploded perspective view of the quick release and locking mechanism of Figure 5a;

Figure 5(c) illustrates a side view of an extended piston end of the compacting ram shown in Figure 3 to Figure 5b; and

30 Figure 6 is a schematic flow chart illustrating one embodiment of a method of collecting material for a compactor.

DETAILED DESCRIPTION

Figure 1(a) illustrates a schematic perspective view of one embodiment of a compactor 100 having an internal compacting ram (not shown). The compactor 100 includes a compactor main body 102 coupled to the internal compacting ram (not shown) via a ram head 104. In some embodiments, the main body 102 may be welded to the ram head 104. However, it is understood that other connection methods may also be used. The compacting ram (not shown) and main body 102 define a compaction chamber 105 for receiving and compacting trash. The main body 102 of the compactor 100 has a top surface that is designed to function as a holding area or a collecting hopper 108. The hopper 108 may be coupled to the top surface of the main body 102, or it may be formed integrally therewith.

In this embodiment, the hopper 108 may include side flaps 110, 112 that can be extended from the hopper 108 with brackets (not shown) using hinges e.g. 114, 116. The extension can be performed manually or via automation. With reference to Figure 1(b), the right side flap 112 may include a right side extension wing 126 connectable to a right side extension wing 128 which is in turn connected to a right side extension wall 130. The left side flap 110 may include a left side extension wing 132 connectable to a left side extension wing 134 which is in turn connected to a left side extension wall 136. It is understood that other arrangements of the side flaps 112 may also be used.

Figure 1(b) illustrates an exploded perspective view of the compactor 100 of Figure 1a. The internal compacting ram is designed to compact trash and garbage which falls in front of a ram box 106, either directly, or by falling from the collecting hopper 108. The internal compacting ram then pushes the ram box 106 and compacts the garbage into the compaction chamber 105. In this embodiment, the ram head 104 may include a ram head cover 138 coupled to a left panel 140 and a right panel 142. The left panel 140 and the right panel 142 are coupled to a base plate 144 and a ram head front plate 146. The ram head front plate 146 may be connected to a compactor enforcement frame 148.

In the example embodiment, the hopper 108 may be inclined at an angle of from about 20° to about 30° to the horizontal and therefore, has a sloping height to the entrance (or compactor opening) 118 of the ram head 104. The surface of the hopper 108 serves as a holding or receiving area to collect and trap material e.g. garbage bags that are loaded onto the compactor 100. For example, the hopper 108 serves as a receiving area for temporarily receiving and holding bags of garbage when they are thrown or lowered from a height from ships. The inclination or slope of the hopper 108 enables material to be pushed or channelled relatively easily into the compactor opening 118 of the ram box 106, with the help of gravitational force. In addition, if the compactor is used at sea, the moving motion and trim of the carrying vessel at sea can provide a vibrating force that automatically pushes material on the hopper 108 towards the compactor opening 118 of the ram box 106. In the example embodiment, the hopper 108 is made from a steel plate which is rolled or pressed to obtain the desired shape. The hopper 108 may be painted with marine paint to prevent rust.

Furthermore, due to the inclined top surface (the hopper 108) and a larger compactor entrance 118, a design for a shorter ram box 106 is used. In the example embodiment, the ram box 106 is about 500mm in length as compared to about 900mm for conventional ram boxes. In the example embodiment, the compactor entrance 118 is about 1m x 2m in area as compared to about 0.9 x 1.6m for conventional compactor entrances.

In the example embodiment, material is deposited/pushed into the compactor opening 118 via the hopper 108 and the ram box 106. The compacting ram 103 is used to compact the material into the compaction chamber 105. Numeral 120 is used to show an approximate depth of the compacting carried out by the compacting ram 103 from the ram head 104 end.

In the example embodiment, the compactor 100 has a storage capacity of about 10 m³ and a sloping height not exceeding about 1.7m (maximum height shown at numeral 122). For this capacity, the compactor 100 has a maximum overall length of about 4.4m. In the example embodiment, the hopper 108 has a surface area of at least

about 3 m x 2.4m (ie. when the flaps 110, 112 are not extended). The dimensions can enable the compactor 100 to be used in existing vessels/craft without any modifications on the decks of the craft. Further, due to the reduced height of the compactor 100 when compared to existing compactors, the compactor 100 can allow an unobstructed line of sight for an operator of the craft to view the area surrounding the craft from a wheel house, such that navigation of the craft is not affected. Further, the height of the compactor 100 can also allow easier handling of e.g. garbage bags transferred laterally by an operator.

Figure 2(a) illustrates a side view of the compactor 100 of Figures 1a and 1b installed on a deck of a vessel/craft. Figure 2(b) illustrates a top view of the compactor 100 of Figure 2(a). The compactor 100 is installed on a deck of a craft 204. With the inclined surface of the hopper 108, the line of sight 208 for view from the wheel house 210 of the craft 204 is unobstructed. An open bin 212 may be provided for collecting items that are not compactable, for example, wooden boxes and steel drums.

It will be appreciated that if a bigger volumetric capacity of the compactor is desired and length of the compactor is not a constraint, then the dimensions can be adjusted to suit any craft.

In the example embodiment, the end indicated at numeral 124 of the compactor 100 is configured to be an opening door so that compacted material or garbage in the compactor 100 can be discharged from the end 124. This can be performed by means of a hydraulic cylinder of a lorry/vehicle tipping the compactor 100 to discharge the compacted material or garbage from the end 124. In the example embodiment, the internal compacting ram is transported together with the compactor 100. However, it is understood that other configurations are also possible in which only the container is transported.

Figure 3(a) illustrates a perspective view of a compactor 300 showing an external compacting ram assembly 301. Figure 3(b) illustrates a side view of the compactor 300 of Figure 3a. Figure 3(c) illustrates a top view of the compactor 300

of Figures 3a and 3b. Figure 3(d) illustrates a front view of the compactor 300 of Figures 3a-3c. The principles of operation of the collecting area or hopper 302 are substantially identical to the above example embodiment described with reference to the compactor 100 of Figure 1.

5

In this example embodiment, a removable external cylinder ram design is used to provide an external hydraulic cylinder 304 for compacting garbage within the compaction chamber. A quick release (releasable) locking mechanism 414 (Figure 5(a)) ensures a simple and fast operation for locking and releasing the external cylinder 304.

10 The releasable locking mechanism provides for attachment of the ram assembly 301 during compaction operations, and quick disengagement from the compactor 300 when the compactor 300 is full. The compactor 300 may then be lifted onto a truck for transportation to an incinerator or landfill.

15

In the example embodiment, the external cylinder 304 is engageable/connectable to a compacting ram 303 of the compactor 300. The external cylinder 304 is connected using a two-step locking process that comprises locking the external cylinder 304 to a compactor/ram head wall 308 and then locking a piston of the external cylinder 304 to a ram box of the compacting ram 303.

20

Figure 4(a) is a schematic side view of the external cylinder 304 connected to the compacting ram 303. The external cylinder 304 is mounted and held in position by a cylinder stand 402. The stand 402 is movable along a rail guide pair 403. Alternatively, the stand 402 may be mounted to a deck of a vessel (not shown). Two locking pins 404, 406 (also shown in Figure 3) are provided to hold the external cylinder 304 to the ram head wall 308. The pins 404, 406 are inserted into locking members e.g. 408 provided on the ram head wall 308 to hold the external cylinder 304 to the ram head wall 308. An extended piston end 410 of the external cylinder 304 is locked onto a wall 412 of the compacting ram 303 using a quick release and locking mechanism 414 that comprises

25 a rotating handle or lever 416. The quick release and locking mechanism 414 is provided on the wall 412 of the compacting ram 303. In the example embodiment, the wall 412 may also be known as a ram head rib plate. In operation, the external cylinder 304 can

30

effect compacting via the piston 410 and the compacting ram 303 in the direction indicated by numeral 418.

Figure 4(b) is a schematic exploded view of the external cylinder 304 for connection to the ram head wall 308. Figure 4(c) is a schematic perspective view of the assembled components illustrated in Figure 4(b). The extended piston end 410 of the external cylinder is connectable to a piston rod end 424 using an extension rod linkage component 421 and a pin 423. The cylinder mounting plate 422 is connected to a ram head wall plate adapter 426 using e.g. bolts and nuts 428. The locking members e.g. 408 are provided on a locking pin plate 430 which is in turn provided on the ram head wall 308 (not shown in Figure 4(b)). For connecting the external cylinder 304 to the ram head wall 308, a protruding mating member 432 of the ram head wall plate adapter 426 is engaged into a mating recess 434 of the locking pin plate 430. The ram head wall plate adapter 426 can then be locked to the locking pin plate 430 using locking pins 404, 406 (not shown in Figure 4(b)) inserted through the locking members e.g. 408. It is understood that other methods of connecting the external cylinder 304 to the ram head wall 308 may also be used.

Figure 5(a) is a schematic front view diagram illustrating the quick release and locking mechanism 414 when viewed from the position 420 of Figure 4.

The quick release and locking mechanism 414 may include the rotating handle or lever 416, a biasing means 502 such as a spring, a right angle link bar 504 connected to the biasing means 502 and the lever 416, a link bar 508, a bolt 510 for connecting the link bar 508 to the right angle link bar 504 and a fork locking plate 512 connected to the link bar 508. The fork locking plate 512 includes at least one piston-engaging member e.g. a pair of fork guides 514 and 516. The fork locking plate 512 is movable along the fork guides 514 and 516 between a released position (indicated at arrow 518) and a locked position (indicated at arrow 520), depending on the rotation direction of the lever 416.

Figure 5(b) is a schematic exploded view for illustrating the quick release and locking mechanism 414 of Figure 5(a). The lever 416 comprises a handle key 526

inserted into a handle guide 528. The handle guide 528 is welded to ram head wall 308. Handle key 526 is connected to a control pin 530, which is connected to a square hole 532 of the right angle link bar 504. A piston guide wall 534 is provided for guiding the extended piston end 410 (not shown in Figure 5(b)). The piston guide wall 534 is provided on fork guides 514 and 516. The quick release and locking mechanism 414 components are provided on a mid section plate 536. The mid section plate 536 is aligned with and coupled to the ram head rib plate 412 such that the extended piston end 410 (not shown in Figure 5(b)) can be inserted via an aperture 540 of the mid section plate 536. In the example embodiment, the mid section plate 536 may be coupled to the ram head rib plate 412 using welding.

Figure 5(c) is a schematic perspective view of the extended piston end 410. The extended piston end 410 comprises a groove 524 that is provided along the circumference of the extended piston end 410 for engaging the fork locking plate 512.

In use, when the lever 416 is turned in a clockwise direction, the fork locking plate 512 slides along the fork guides 514 and 516 to the locked position (indicated at arrow 520) and the fork locking plate 512 engages the extended piston end 410 via the groove 524. The cylinder 304 is thus in position to effect compacting. The biasing means 502 provides a biasing force indicated at numeral 522 so as to maintain the fork locking plate 512 in a default locked position (indicated at arrow 520). In the example embodiment, the piston of the cylinder 304 can be mounted or released by performing a quarter turn of the lever 416.

In the example embodiment, to release the extended piston end 410, the lever 416 is turned in an anti-clockwise direction (ie. against the biasing force at 522) to slide the fork locking plate 512 along the fork guides 514 and 516 to the released position (indicated at arrow 518) such that the fork locking plate 512 disengages from the groove 524 of the extended piston end 410.

In the example embodiment, the cylinder size of the external cylinder 304 determines the compacting ratio of the compactor 300. It has been recognised that a compacting ratio by weight of about 4 to 5 times can be achieved. For example, a

cylinder having a cylinder bore diameter of about 125mm and a piston rod diameter of about 70mm can provide a compacting ratio by weight of about 4 to 5 times.

Figure 6 is a schematic flow chart 600 illustrating a method of collecting material for a trash compactor in an example embodiment. At step 602, a material receiving surface coupled to a compaction chamber is provided, said surface inclined at an angle to the horizontal. At step 604, material collected on said surface is deposited into a ram chamber entrance of the trash compactor under gravitational force.

Thus, in the above described example embodiments, a compactor can be provided for garbage handling and collection in a small craft, without interference of line of sight from a wheelhouse of the craft. In the above described example embodiments, a sufficiently large area for holding garbage can be provided before the garbage is compacted in the compaction chamber of the compactor. This can advantageously provide a fast and efficient way of collecting garbage from moored ships. In the above described example embodiments, smelly and unsightly garbage storage can be prevented while facilitating an easier and greener way of handling seaborne garbage. In addition, a compactor can be provided with either an internal or an external compacting cylinder design.

It will be appreciated that although the description mentions using the compactor for e.g. seaborne garbage, the compactor of the described example embodiments can be used for land-based garbage handling as well. Further, the example embodiments are not limited to collection and compaction of garbage but can include other material, e.g. scrap metal or recycled material.

It will be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

CLAIMS

1. A trash compactor comprising,
a material receiving surface coupled to a compaction chamber and disposed
5 on the compaction chamber, the material receiving surface being inclined at an
angle to the horizontal such that material collected on said surface is deposited into
an entrance of the compaction chamber under gravitational force; and
a compacting ram head wall disposed at an opposite end of the entrance
from the material receiving surface to compact deposited material towards a
10 direction of the inclination of the material receiving surface.
2. The trash compactor as claimed in claim 1, wherein the material
receiving surface comprises extendable flaps for extending a surface area of said
surface.
15
3. The trash compactor as claimed in claims 1 or 2, wherein the angle is
in a range of about 20° to about 30°.
4. The trash compactor as claimed in any one of claims 1 to 3, wherein
20 the trash compactor is suitable for installation on a seaborne craft such that the
installed trash compactor provides an unobstructed line of sight for an operator of said
craft to view an area surrounding the craft from a wheel house of the craft.
5. The trash compactor as claimed in any one of claims 1 to 4, further
25 comprising a compaction mechanism coupled to said compacting ram head wall and
capable of exerting a compacting force within said compaction chamber.
6. The trash compactor as claimed in claim 5, wherein said compaction
mechanism comprises an external hydraulic cylinder releasably coupled to said trash
30 compactor.

7. The trash compactor as claimed in claim 6, wherein the external hydraulic cylinder is locked to a compactor wall and a piston of the external hydraulic cylinder is locked to the compacting ram head wall using a releasable locking mechanism.

5

8. The trash compactor as claimed in claim 7, wherein the releasable locking mechanism comprises a piston engaging member for engaging the piston.

9. The trash compactor as claimed in claim 8, wherein the releasable locking mechanism further comprises a lever connected to the piston engaging member, said lever being rotatable to move the piston engaging member between a released position and a locked position.

10. The trash compactor as claimed in claim 9, wherein the piston engaging member is moved between the released position and the locked position via a quarter turn of the lever.

11. The trash compactor as claimed in claims 8 or 9, wherein the releasable locking mechanism further comprises a biasing means for providing a biasing force to maintain the piston engaging member in the locked position.

12. The trash compactor as claimed in any one of claims 8 to 11, wherein the piston engaging member comprises fork guides and a fork locking plate.

13. The trash compactor as claimed in any one of the preceding claims, wherein the trash compactor comprises a ram box having a length not more than about 500mm.

14. A method of collecting material for a trash compactor, the method comprising the steps of:

providing a material receiving surface coupled to a compaction chamber, the material receiving surface being disposed on the compaction chamber, with said surface inclined at an angle to the horizontal;

depositing material collected on said surface into a ram chamber entrance of the trash compactor under gravitational force;

providing a compacting ram at an opposite end of the entrance from the material receiving surface; and

5 compacting the deposited material towards a direction of the inclination of the material receiving surface.

15. The method of claim 14 further comprising installing said trash compactor on a seaborne craft.