

PATENT SPECIFICATION

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(54) TRIMMING AND EMPTYING DEVICE FOR BULK MATERIAL

(71) We, HAAHJEM MEKANISKE A/S, a Norwegian Body Corporate of 6040 Vigra, Norway do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

The present invention relates to a trimming and emptying device for bulk material in a cargo or storage room, comprising at least one raking device which is arranged to move the bulk material in one of the main directions of the room and which is movable vertically and transversely of the direction of motion of the bulk material.

A device of this type is shown for instance in French Patent Specification Nos. 1,343,751 and 911,594. Using such devices, for instance in a ship, for unloading the ship, it is necessary to move the bulk material up and inclined plane to one or more band conveyors running transversely of the direction in which the bulk material is being moved by the raking devices. The band conveyors take up space and thus reduce the net cargo volume of the room. Besides, since the band conveyors are placed near the bottom of the ship, access for repair and maintenance work is difficult.

In certain shipboard uses, especially in larger ships, frames, reinforcing plates and webs often protrude into the cargo room, thus making it impossible for the raking devices to remove the bulk material adjacent to the outer walls of the room. Furthermore, the raking devices will not be able to cover the entire cross section of the room should the room have varying width in the vertical direction since the guiding beams of the raking devices are dependent upon vertical guides.

According to the present invention there is provided apparatus for emptying bulk material from a storage chamber, the apparatus comprising first rake means in the storage

chamber for transporting material in the storage chamber in a first direction therein, means for moving the first rake means vertically, means for moving the first rake means transversely of the first direction, vertical transport means for transporting material from the storage chamber upwards for removal from the storage chamber, second rake means in the storage chamber extending at an angle with respect to the first rake means for transporting material in the storage chamber in a second direction therein to the vertical transport means, and means for moving the second rake means vertically, the second rake means being positioned adjacent one end of the first rake means for receiving material transported by the first rake means in the first direction and for transporting the material in the second direction to the vertical transport means.

The invention is illustrated, by way of example, with reference to the accompanying drawings in which:-

Figure 1 shows a cross section through the cargo room of a ship where apparatus according to the invention is installed without a bulky horizontal band conveyor in the lower part of the cargo room;

Figure 2 shows a cross section of a ship cargo room having varying width in the vertical direction;

Figure 3 shows a longitudinal cross section through a cargo room of the ship with apparatus according to the invention;

Figure 4 shows a part of the apparatus shown in Figure 1 on a larger scale, while

Figure 5 shows the apparatus of Figure 4 viewed in the direction of the arrows V-V.

Figure 1 shows a cross section of a ship hull 1 with a cargo room 2 in which is installed a raking device 3. The raking device is able to move bulk cargo in the longitudinal direction of the ship, and is moveable transversely to the longitudinal direction of the ship along guiding beams 4 which in turn are

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movable vertically in guides (not shown) at its ends. Furthermore, at one end of the raking device 3, a similar raking device 5 is arranged extending at an angle to the raking device 3, preferably transversely of the latter. The transverse raking device 5 is able to move the bulk cargo towards a vertical transporting device 6 placed for instance near one side of the cargo room. In the embodiment shown, the vertical transporting device 6 takes the form of bucket conveyor delivering bulk cargo to a band conveyor 7 on the deck of the ship. Instead of a bucket conveyor, a screw conveyor or any other suitable vertical transporting device may be used. The transverse raking device 5 may be divided in two or more raking devices delivering bulk cargo to the same or separate vertical transporting devices. The transverse raking device is moveable vertically, for instance by means of suspension members 8 of variable length. The transverse raking device is preferably held at a somewhat lower level than the main raking device 3 so that a certain slip angle is obtained from the latter. Thus the material falls under the action of gravity, resulting in energy savings.

By using a transverse raking device together with a vertical transporting device, a higher degree of filling of the cargo room is obtained since the dead volume beneath inclined planes leading to the transverse band conveyors, is avoided. Furthermore, repair and maintenance work becomes easier because the rakes at all times may be situated above the cargo.

Figure 2 shows how a raking device is installed in a cargo room 2 with substantially varying width in the vertical direction. The raking device 3 with the guide beam generally designated 4 are shown in solid lines in the upper position and in broken lines in a lower position. The lower position illustrates how the guide beam 4 is constituted by two outer sections 4' telescopically arranged in a middle section 4". The outer sections 4' of the guide beam are at their outer ends equipped with rollers 9 or the like sliding in guides 10 which generally follow the side walls of the cargo room. The middle section 4" of the guide beam is shorter than the smallest distance between the guides 10.

The middle section 4" of the guide beam may alternatively be arranged floating on the two outer sections 4' in order for it to be moveable with the raking device 3 all the way out to the guides 10 even when the guide beam is located in a lower position. Thereby, possible problems are avoided since the raking device 3 does not have to be moved from the middle section 4" to one of the outer sections 4', or vice versa.

Figure 3 shows a longitudinal cross section through the cargo room 2. It is furnished with a main rake 3 which moves bulk material in

the longitudinal direction of the cargo room, a transverse rake 5 and a vertical transporting device 6. The main rake 3 is equipped with an excavating arm means 11 which is moveable and pivotably arranged on the rake. By means of the excavating arm bulk material may be extracted from between frames 12 and stiffening plates 13 so that the main rake 3 or the transverse rake 5 may move the material towards the vertical transporting device. Since the excavating unit is movable on the rake, it is able to reach all remaining material between or on protrusions so that the vessel in most cases may be completely unloaded without further equipment.

Figure 4 shows in greater detail an especially suitable embodiment of the transporting device 6. It is constituted by a band conveyor with buckets 14 attached to a number of endless chains 15 running over upper and lower driving and turning wheels 16, of which only the lower one is shown.

That part of the bucket conveyor which at any time lies below the level of the surrounding bulk material, is protected by plates 17 which are attached to chains which run over lower turning wheels 19. The plates 17 and the chains 18 together form a roll-front type device whose upper edge 20, as is best shown in Figure 5, may be withdrawn to expose the bucket conveyor as the level of the bulk material is reduced. The upper edge 20 of the roll-front device is at all times held somewhat lower than the transverse rake 5 so that the bulk material may slide from the end of the rake down into the buckets 14 of the conveyor.

The expression "vertical transporting device" used in the preceding description and in the following claims is not meant to be restricted to a transporting device arranged absolutely vertically in the room, but may comprise any suitable transporting device able to move the bulk material from a lower to a higher level. Furthermore, more than one vertical transporting device may be arranged in a single room where this may be deemed expedient.

Our copending application No. 29809/78 (Serial No. 1567878) divided herefrom, describes similar apparatus but claims different subject matter.

WHAT WE CLAIM IS:-

1. Apparatus for emptying bulk material from a storage chamber, the apparatus comprising first rake means in the storage chamber for transporting material in the storage chamber in a first direction therein, means for moving the first rake means vertically, means for moving the first rake means transversely of the first direction, vertical transport means for transporting material from the storage chamber upwards for removal from the storage chamber, second



movable vertically in guides (not shown) at its ends. Furthermore, at one end of the raking device 3 a similar raking device 5 is arranged extending at an angle to the raking device 3, preferably transversely of the latter. The transverse raking device 5 is able to move the bulk cargo towards a vertical transporting device 6 placed for instance near one side of the cargo room. In the embodiment shown, the vertical transporting device 6 takes the form of bucket conveyor delivering bulk cargo to a band conveyor 7 on the deck of the ship. Instead of a bucket conveyor, a screw conveyor or any other suitable vertical transporting device may be used. The transverse raking device 5 may be divided in two or more raking devices delivering bulk cargo to the same or separate vertical transporting devices. The transverse raking device is moveable vertically, for instance by means of suspension members 8 of variable length. The transverse raking device is preferably held at a somewhat lower level than the main raking device 3 so that a certain slip angle is obtained from the latter. Thus the material falls under the action of gravity, resulting in energy savings.

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5 rake means in the storage chamber extending at an angle with respect to the first rake means for transporting material in the storage chamber in a second direction therein to the vertical transport means, and means for moving the second rake means vertically, the second rake means being positioned adjacent one end of the first rake means for receiving material transported by the first rake means in the first direction and for transporting the material in the second direction to the vertical transport means.

10 2. Apparatus according to claim 1 wherein the vertical transport means comprises bucket means for transporting the material upwards for removal from the storage chamber.

15 3. Apparatus according to claim 1 or 2 wherein the first and second rake means extend in horizontal planes at right angles to one another.

20 4. Apparatus according to claim 3 comprising excavating arm means on the first rake means for removing bulk material at the perimeter of the storage chamber towards the first rake means.

25 5. Apparatus according to any one of claims 1 to 4 wherein the vertical transport means comprises cover plates extending vertically adjacent the second rake means and means for progressively moving the cover plates downwardly as the storage chamber is emptied of material.

30 6. Apparatus according to claim 5 wherein the vertical transport means further comprises means connecting the cover plates in roll-front manner.

35 7. Apparatus according to claim 6 wherein the vertical transport means further comprises vertically arranged band means, the cover plates being attached to the band means, and roller means drivingly engaging the band means.

40 8. Apparatus according to claim 7 wherein the roller means is located proximate the bottom of the vertical transport means.

45 9. Apparatus according to any one of claims 1 to 8 wherein the storage chamber is substantially rectangular and includes opposite pairs of bounding walls, the vertical transport means being located proximate one of the walls.

50 10. Apparatus according to claim 9 wherein the first rake means extends parallel to one of the pair of walls, the second rake means extending parallel to the other of the pair of walls, the wall which the vertical transport means is proximate to being one of the one pair of walls.

55 11. Apparatus according to any one of claims 1 to 10 wherein the second rake means is positioned at a level below the first rake means.

60 12. Apparatus for emptying bulk mater-

ial from a storage chamber substantially as hereinbefore described with reference to the accompanying drawings.

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