Fluidization of an entire hold can lead to the maximum loading capacity of the vessel being exceeded and corrosion in the hull structure. Additionally, there are various regulations that must be adhered to, for example, with regard to stability and structural integrity. Most unloading systems invented up to now require conversion of the bulk carrier into a slurry for offloading and transport elsewhere, but this has not proven to be economically feasible.

SUMMARY

According to a first aspect of the invention, a hold offloading system comprises a holding space for containing a material; and a localized fluidization-suction-pump-drive system for locally fluidizing the material and transporting the fluidized material out of the holding space. The fluidization-suction-pump-drive system includes a fluidization portion and a suction head in proximity to the fluidization portion for suctioning the locally fluidized material, wherein nozzles of the fluidization portion are positioned at points around the suction head and directed toward the suction head.

Such a system allows for local fluidization within a holding space and removal of that locally fluidized material from the holding space with very few or no modifications required for a typical holding space (or a vessel if the holding space is located within a vessel). The proximity of the fluidization portion and the suction head promotes immediate removal of the fluidized material after fluidization, reducing the residual fluidized material and/or fluid that weighs on holding space and acts to corrode the holding space. Thus, such a system can allow for the cost-effective use and unloading of large holding spaces and/or vessels, such as bulk carriers.

According to an embodiment, the localized fluidization-suction-pump-drive system comprises a movable fluidization-suction-pump-drive system which can be moved around in the holding space for locally fluidizing the material and transporting the material out of the holding space. This can allow for removal of all material within a holding space no matter the size or shape. Additionally, the ability to move such a system around means that fewer or no modifications need to be made to the holding space to ensure full emptying of the space when desired.

According to an embodiment, the localized fluidization-suction-pump-drive system is removable from the holding space. This can be an advantage for various situations where the system is not desired or needed, for example, upon loading of the holding space. Additionally, the holding space will have more holding capacity when the localized fluidization-suction-pump-drive system is completely removed from the holding space.

According to an embodiment, the localized fluidization-suction-pump-drive system further comprises a shield to keep the fluidization near the system and ensure the locally

fluidized material is transported out of the holding space through the fluidization-suction-pump-drive system. Such a shield can help to further promote that fluid and localized material stay close to fluidization-suction-pump-drive system for removal through suction head and ensure that the holding space is affected with as little water as possible. The fluidization system can be connected to the shield in some embodiments and/or can be directed toward suction head. This can help to keep fluidization local and help direct the fluidized material toward the suction head for removal.

According to an embodiment, the localized fluidization-suction-pump-drive system works to locally fluidize and transport material from a top of the holding space first.

According to an embodiment, the localized fluidization-suction-pump-drive system is in a container and the material is transported to the container for fluidization. In such a system, the fluidized material is completely within the container, preventing the fluid or fluidized material from flowing to other parts of the holding container. This ensures that fluidization stays local and all fluidized material is directly fed to the suction head.

According to an embodiment, the material is transported to the container mechanically. Such a mechanical system can continuously transport material from the holding space to the container for fluidization and transport out of the holding tank.

According to an embodiment, the hold offloading system further comprises a pump-pipeline system to transport the material hydraulically after the material has been transported out of the holding space. Such a pump-pipeline system can be a reliable and cost effective way to transport a fluidized mixture.

According to an embodiment, a vessel can include the hold offloading system. Optionally, the vessel can be a bulk carrier. The hold offloading system allows for easy and cost-effective use and hydraulic unloading of a vessel while reducing or eliminating the risk of overloading the vessel with fluid.

According to a second aspect of the invention, a method of offloading a holding space comprises locally fluidizing material in a holding space; and transporting the fluidized material out of the holding space. Such a method allows for easy and cost effect unloading of a holding space without overloading the holding space by only locally fluidizing material and then immediately transporting that material out of the holding space, wherein the step of locally fluidizing material in a holding space comprises: introducing a fluid to the material with a fluidization-suction-pump-drive system with a fluidization portion; and removing the fluid and material mixture from the holding space through a suction head of the fluidization-suction- pump-drive system, wherein the fluidization portion and the suction head are located in proximity to each other and the nozzles are positioned at points around the suction head and directed toward the suction head.

Claims

1. A hold offloading system comprising:
a holding space (10) for containing a material; and
a localized fluidization-suction-pump-drive system (12, 12', 12'') for locally fluidizing the material and transporting the fluidized material out of the holding space (10), the fluidization-suction-pump-drive system (12, 12', 12'') with a fluidization portion (14) and a suction head (16) in proximity to the fluidization portion for suctioning the locally fluidized material, wherein nozzles of the fluidization portion (14) are positioned at points around the suction head (16) and directed toward the suction head (16).

2. The hold offloading system of claim 1, wherein the localized fluidization-suction-pump-drive system (12, 12', 12'') comprises:
a movable fluidization-suction-pump-drive system which can be moved around in the holding space (10) for locally fluidizing the material and transporting the material out of the holding space (10).

3. The hold offloading system of any of the preceding claims, wherein the localized fluidization-suction-pump-drive system (12') further comprises:
a shield (26) to keep the fluidization near the system and ensure the locally fluidized material is transported out of the holding space (10) through the fluidization-suction-pump-drive system (12').

4. The hold offloading system of any of the preceding claims, wherein the localized fluidization-suction-pump-drive system (12, 12', 12'') works to locally fluidize and transport material from a top of the holding space (10) first.

5. The hold offloading system of any of the preceding claims, wherein the localized fluidization-suction-pump-drive system (12'') is in a container (30) and the material is transported to the container for fluidization.

6. The hold offloading system of claim 5, wherein the material is transported to the container mechanically.

7. The hold offloading system of any of the preceding claims, and further comprising:

a pump-pipeline system (18, 20) to transport the material hydraulically after the material has been transported out of the holding space.

8. A vessel comprising the hold offloading system of any of the preceding claims, preferably wherein the vessel is a bulk carrier.

9. A method of offloading a holding space (10) comprising:

locally fluidizing material in a holding space (10); and

transporting the fluidized material out of the holding space (10), wherein the step of locally fluidizing material in a holding space (10) comprises:

introducing a fluid to the material with a fluidization-suction-pump-drive system (12, 12', 12'') with a fluidization portion; and

removing the fluid and material mixture from the holding space (10) through a suction head (16) of the fluidization-suction-pump-drive system (12, 12', 12''), wherein the fluidization portion and the suction head (16) are located in proximity to each other and the nozzles are positioned at points around the suction head (16) and directed toward the suction head (16).

10. The method of any of claim 9, and further comprising:

moving the fluidization-suction-pump-drive system (12, 12', 12'') within the holding space to locally fluidize material in different parts of the holding space (10) and remove the fluidized material, preferably wherein the material is fluidized and removed from a top of the holding space (10) to a bottom of the holding space.

11. The method of any of claims 9-10, and further comprising:

positioning a shield (26) near the fluidization-suction-pump-drive system (12, 12', 12''), preferably wherein the shield (26) is connected to the fluidization-suction-pump-drive system (12, 12', 12'') to move with the fluidization-suction-pump-drive system.

12. The method of claim 9, wherein the step of locally fluidizing the material with a holding space (10) comprises:

transporting the material to a container (30); and

fluidizing the material within the container (30).

13. The method of claim 12, wherein the material is transported to the container (30) mechanically.

14. The method of any of claims 9-13, and further comprising

positioning the fluidization-suction-pump-drive system (12, 12', 12'') prior to loading the holding space with material.