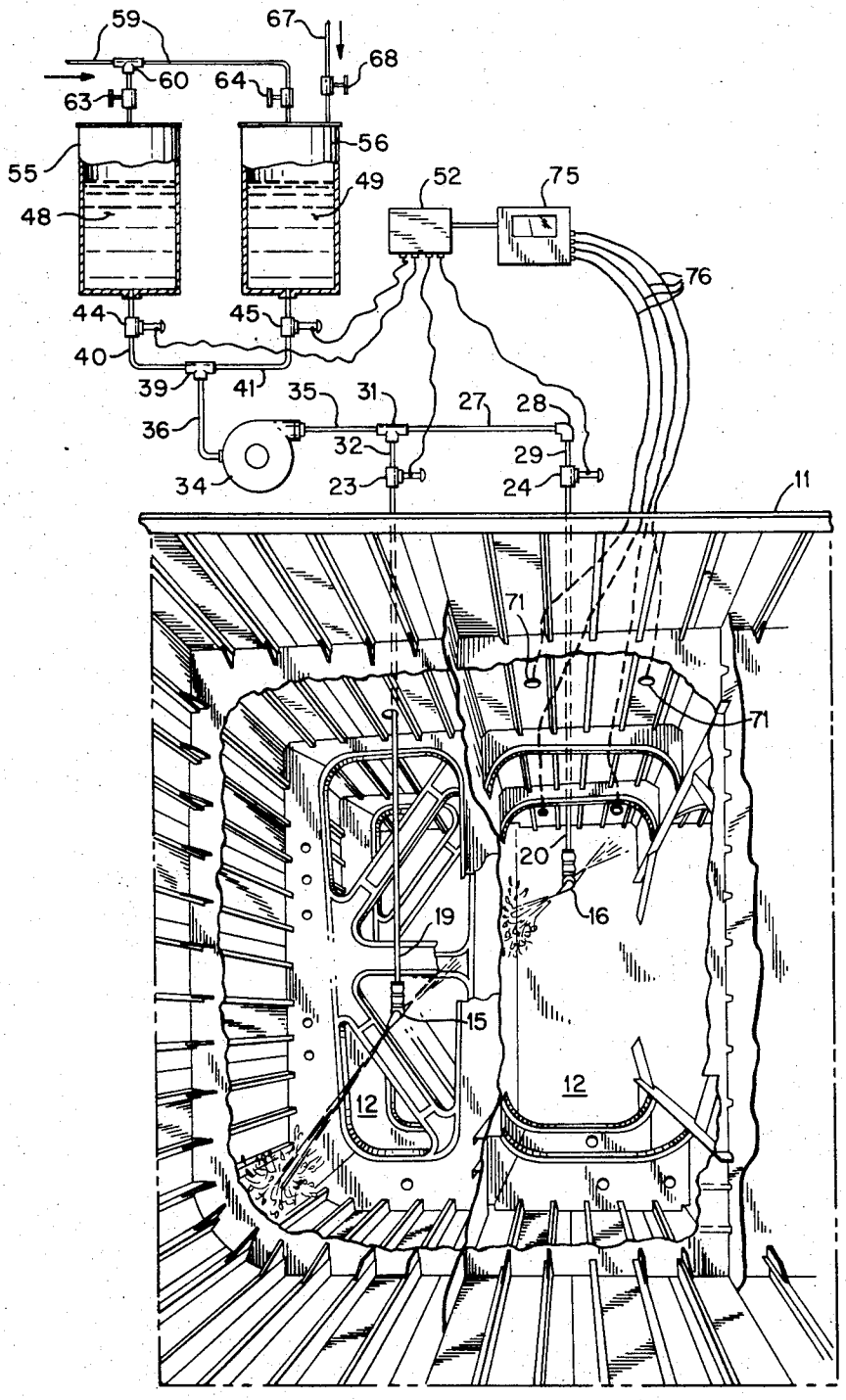
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LARGE SCALE TANK CLEANING METHOD

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LARGE SCALE TANK CLEANING METHOD

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ABSTRACT OF THE DISCLOSURE

A method for cleaning large-scale tanks which are used for containing products that produce explosive mixtures upon washing out the residuals. The washing is done by high-velocity spraying which tends to cause an electrostatic charge to build up in the atmosphere within the tank. The charge is neutralized by alternating between washing fluids that build opposite polarity charges.

BACKGROUND OF THE INVENTION

Field of the invention

This invention concerns a method of cleaning large tanks, in general. More specifically, it relates to a method that is applicable especially to large-scale tanks that may contain products which tend to produce an explosive mixture when the tank is washed out.

Description of the prior art

Heretofore, various approaches have been suggested for eliminating the hazards of possible explosion which develop especially in large-scale tankers. The hazard develops when the walls of interior compartments are washed down, e.g. between cargos. However, the exact cause, or causes, of damaging explosions which have occured are not well defined; and the steps taken to avoid the damage have taken different approaches. It appears that a major problem has been the build-up of an electrostatic charge in the giant tankers particularly, to the point where ionization and accompanying spark discharge may take place. Thus, while various electrical conductor arrangements have been suggested for dissipating the charge, none of the approaches heretofore suggested have been particularly successful.

Consequently, it is an object of this invention to teach a simple yet effective method that obviates the principal cause of explosive danger, by preventing build-up of electrostatic charge beyond safe limits.

SUMMARY OF THE INVENTION

Briefly, the invention concerns a method of controlling electrostatic charge in large-scale enclosures wherein high-velocity liquid spray is employed to wash the interior thereof. The method comprises the steps of employing a liquid, the spray of which produces an electrostatic charge having a given polarity; and alternately employing another liquid, the spray of which produces an electrostatic charge having the opposite polarity in order to neutralize the charge.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects and benefits of the invention will be more fully set forth below in connection with the best mode contemplated by the inventor of carrying out the invention, and in connection with which there are illustrations provided in the drawings, wherein:

The figure of drawings is a schematic illustration, partially in perspective, showing equipment that may be employed in carrying out the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With the advent of large-scale tankers in transporting petroleum products, there has been found to exist a serious problem which relates to the washing of tanks between cargos. There have been a considerable number of extremely damaging explosions that created loss of property and danger to personnel. Attempts to determine the cause and provide for avoiding such danger have included various suggested approaches. Most of such prior approaches have related to something for dissipating the build-up of electrostatic charge. However, insofar as is known, none of these suggestions have been particularly satisfactory, and the danger still tends to exist.

It appears that the most dangerous situation seems to accompany a widely used procedure for washing down the walls of a cargo tank. Such washing procedure employs high-velocity liquid sprays that are ordinarily directed against the walls of the tank from one or more jet nozzles that may be rotated while being raised or lowered within the tank compartment. It has been discovered that when clean sea water is used as the fluid to clean the tanks, there is a tendency to build up an electrostatic charge with a given polarity. On the other hand, when the washing spray liquid is a mixture containing some oil, e.g. recirculated wash water, the electrostatic charge which builds up has an opposite polarity to that created by clean sea water. This invention makes use of such discovery and applies a method for neutralizing electrostatic charge by alternately changing the constituency of the wash liquid so as to reverse the polarity of the electrostatic charge being built up. In that manner and by regulating the duration of such alternate use of different wash liquids, the charge may be maintained below a predetermined level such that no danger of ionization sufficient to cause sparking, will exist.

Referring to the drawing, an example of the steps involved in carrying out the invention with standard equipment will be described. Thus, there is shown in perspective the interior of a large-scale tank ship **11** which has a plurality of tanks or cargo compartments **12** therein. These compartments are normally washed out between cargos to remove residual product from the walls thereof before refilling with a different cargo. The washing is done by employing one or more jet-spray nozzles, e.g. nozzles **15** and **16** illustrated. These nozzles are attached to the lower end of pipes **19** and **20**, respectively, so that they may be raised or lowered while the nozzles are rotated, in order to wash down the walls of the entire compartment.

In order to carry out the steps of the invention, there are valves **23** and **24** for controlling the flow of the washing liquid through the respective pipes **19** and **20** and their respective nozzles **15** and **16**. These valves **23** and **24** might, of course, be manually operable. However, as indicated in the drawing, they are preferably solenoid-controlled valves in order to permit electrically controlled automatic operation thereof.

The pipes **19** and **20** are connected together by a common pipe **27** that connects with the pipe **20** on the other side of the valve **24** by means of an elbow **28** and a short pipe connector **29**. At the other end of the pipe **27**, there is a T-connector **31** that interconnects pipe **19** with a short pipe **32** which leads to the pipe **27** via the valve **23**.

There is a pump **34** that has its outlet connected to the T **31** through a pipe **35**. The inlet to the pump **34** is connected via a pipe **36** to another T-joint **39** that has pipes **40** and **41** also connected thereto. The latter pipes have valves **44** and **45**, respectively, connected therein so as to

control the flow of liquid sources **48** and **49**, respectively, to the inlet of the pump **34**.

Here again, while the valves **44** and **45** might be manually controlled, it is preferable to provide for electrical control by having solenoid valves which may be controlled from a control unit **52**.

The respective bodies of liquid **48** and **49** may be contained in tanks **55** and **56**, as illustrated. These tanks will be filled from appropriate sources such as those indicated, e.g. by having an inlet pipe **59** that is connected to a source of clean sea water. Pipe **59** leads to both tanks **55** and **56** via a T-connector **60**. There may, of course, be valves **63** and **64** for controlling the amount of sea water that is introduced to the tanks. The tank **56** has, in addition, an inlet pipe **67** that has a valve **68** therein. This connection is provided to introduce an additive for changing the characteristics of the liquid **49**. It may be noted that recirculated wash water might be returned to the tank **56** through this pipe **67**, if desired.

In order to determine the electrostatic charge of the atmosphere within the compartments **12**, there are a plurality of so-called field mills **71** that are located in the top wall of the compartments. These are specially constructed units which act to measure the amplitude and polarity of the electrostatic charge which exists in the tanks. Any feasible type of such units may be employed, and one example of such unit is described in a book entitled "Electrostatics in the Petroleum Industry—The Prevention of Explosive Hazards," edited by A. Klinkenberg and J. C. Van der Minne, Elsevier Publishing Co., New York, 1958, starting on page 173, Appendix III, "Detailed Description of an Electrostatic Field Strength Recorder." Also, there are available commercial instruments, e.g. two different models marketed by Dynasciences Corporation, Blue Bell, Pa., Model DO–7, and Model CM–27 Electrostatic Field Meters.

In carrying out the steps of this invention, the washing process will be commenced while employing only the liquid from source **48**, i.e. clean sea water. This will be continued until the electrostatic charge in the atmosphere (within the tanks **12**) has reached a predetermined amplitude. The charge and its polarity will be indicated by a meter **75** that has electrical circuit connections **76** leading from the field mills to the meter **75**.

When a predetermined charge level has been reached, there will be a set of control signals developed in the unit **52** so that the valve **44** will be closed and the valve **45** opened. This will change the constituency of the liquid spray from the clean sea water **48** to the liquid **49**, which has characteristics such as to produce an electrostatic field of the opposite polarity. The wash liquid **49** will be employed until the charge has been reduced through zero and, thereafter, until it has built up a charge with the opposite polarity. This will be continued until a charge amplitude like that for shifting the wash liquids previously, has been reached. At that time, the state of the valves **44** and **45** will be reversed once more, so that the wash liquid is shifted back from liquid **49** to liquid **48**. The electrostatic charge in the atmosphere in tanks **12** will thus reverse and be maintained below a safe limit.

It is to be noted that the method could be carried out by manual manipulation, with timing of the alternate use of two different wash liquids. This could be done by determining the intervals in an empirical manner. However, it would be preferable to have a determination made of the amplitude of the electrostatic field at all times, in order to insure the maintenance of safe conditions. It would be expected that the alternate washing with each of the liquids should be carried out for a period of time that is between about ten to thirty minutes. Such timing should insure the neutralization of electrostatic charges and avoid exceeding a dangerous level for either polarity.

It will be appreciated that while clean sea water may

be employed as one of the liquids, and clean sea water with an additive (such as a detergent) may be employed for the other liquid, there may be other and different liquids that could be employed to obtain similar results. For example, it is believed that fresh water tends to create a negative electrostatic field which is also true of sea water having a particular additive known by the trade name Daisic therein. On the other hand, clean sea water provides a positive electrostatic field, so that the alternate fluids employed might be any of the first-named liquids while clean sea water is the alternative wash fluid.

In addition, it has been found that oily water, such as that created by recirculating of the accumulated wash liquid, creates a fluid that tends to provide a negative polarity. However, in any event, it will be appreciated that the method will operate as desired so long as the alternatively employed wash liquids tend to create an electrostatic field of different polarities.

While a particular embodiment according to the invention and in accordance with the applicable statutes has been described above in considerable detail, this is not to be taken as in any way limiting the invention, but merely as being descriptive thereof.

What I claim is:

1. Method of controlling electrostatic charge in large-scale enclosures wherein high-velocity liquid spray is employed to wash the interior thereof, comprising the steps of

employing a liquid the spray of which produces an electrostatic charge having a given polarity, and

alternately employing another liquid the spray of which produces an electrostatic charge having the opposite polarity in order to neutralize the charge.

2. Method according to claim **1**, further including the steps of measuring the amplitude of said charge, and

changing from one to the other of said liquids when said amplitude has reached a predetermined level in order to avoid any spark discharge.

3. Method according to claim **2**, wherein said first liquid is clean sea water, and

said other liquid is sea water with a predetermined additive.

4. Method according to claim **3**, wherein said other liquid is recirculated wash water.

5. Method according to claim **1**, wherein

said alternate steps are carried out for a predetermined period of time each.

6. Method according to claim **5**, wherein

said period of time is between about ten and thirty minutes.

7. Method according to claim **5**, wherein

said first liquid is clean sea water, and

said other liquid is sea water with a predetermined additive.

8. Method according to claim **7**, wherein

said other liquid is recirculated wash water.

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