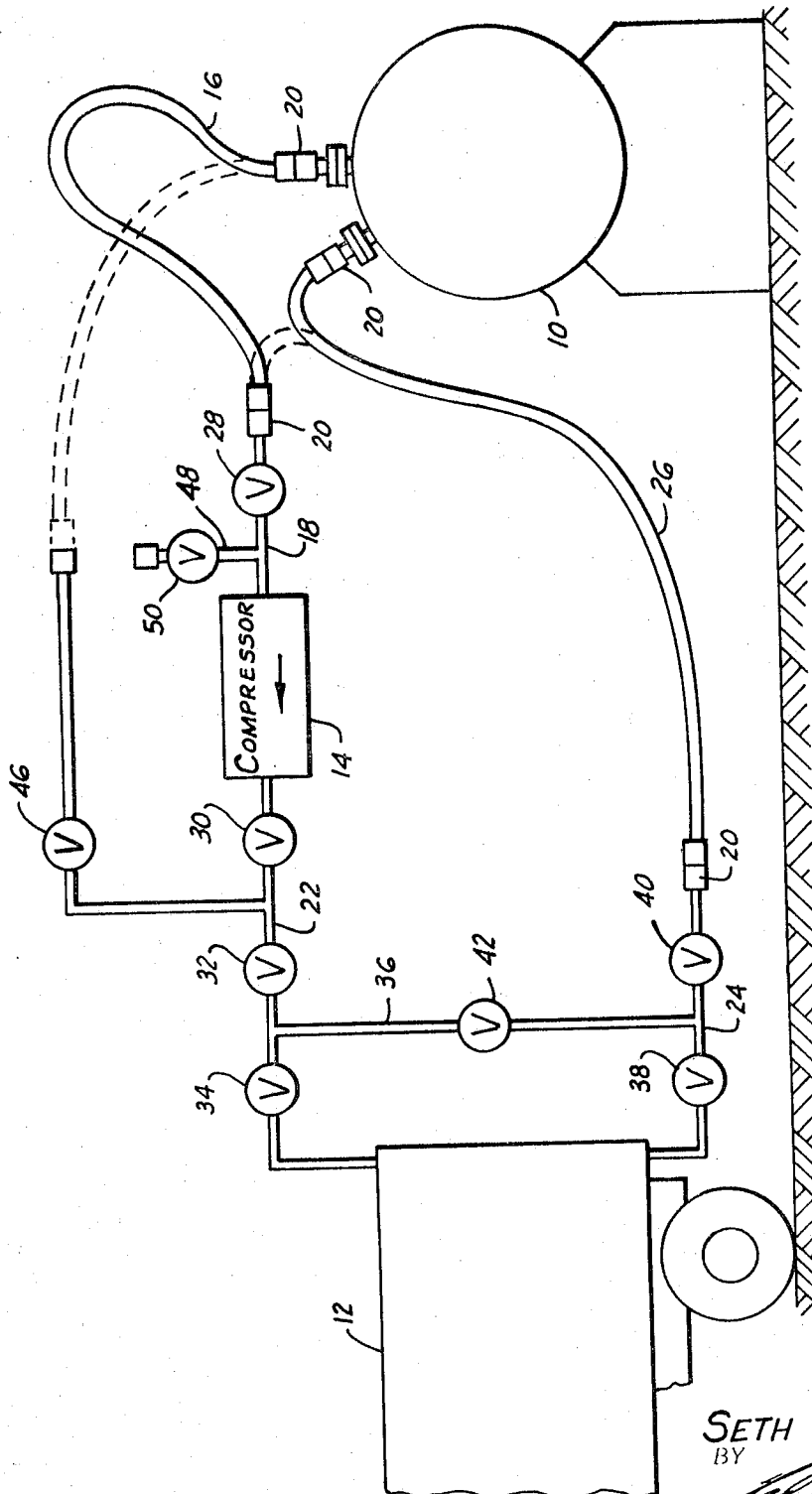


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ODORIZER TRANSFER SYSTEM

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ODORIZER TRANSFER SYSTEM

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ABSTRACT OF THE DISCLOSURE

A system for transferring liquid from a transport tank to a storage tank in which gas from the storage tank is compressed to pressurize the transport tank and force liquid therefrom into the storage tank. When the storage tank is filled to the desired level, a change of valving allows purging of liquid from connecting conduits by means of gas within the system. Another change of valving and of hose connections allows repressuring of the storage tank by means of gas within the system. Provision is also made for introducing additional gas into the system where required for pressurizing the tanks.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to methods and apparatus for transfer of liquids and gases between containers. It is principally designed for the transfer of natural gas odorizing liquids, such as mercaptans, from a truck or railway tank car to a storage tank, while avoiding the release to the atmosphere of any substantial portion of the odorizing material or of the gas in the system.

Description of the prior art

In the past it has been the practice to transfer mercaptans and other natural gas odorizing materials from a tank truck or a railway tank car to a storage tank by merely pumping the liquid through a hose connected between the transport tank and the storage tank. Since the storage tank is normally under a pressure of gas, such as natural gas, it was necessary to vent the tank to the atmosphere in order to prevent a pressure buildup which would prevent pumping the liquid into the storage tank. At the same time, it was necessary to open the transport tank to the atmosphere to avoid reduction of pressure within the transport tank which would make the pumping operation very difficult. It is objectionable to vent such tanks to the atmosphere for several reasons. For one thing, the odorizing materials have a very strong odor which is very disturbing to people in the vicinity. In the second place, the gas in the system is highly flammable and might be accidentally ignited if allowed to escape.

The use of pressurized gas in a closed system to transfer a liquid from one container to another has been previously shown, as for example in U.S. Patents 2,502,525 and 2,854,826. However, such prior art methods do not contemplate the substantially complete elimination of escape of gases and vapors to the atmosphere but, as a matter of fact, actually involve the release of some gas or vapor to the atmosphere.

Furthermore, such prior art systems failed to provide means for avoiding loss of liquid or vapor to the atmosphere upon disconnection of the transport tank and the storage tank.

Both of these are extremely important in the transfer of noxious materials such as mercaptans and some other materials which must be transferred from one tank to another.

SUMMARY OF THE INVENTION

According to the present invention, the loss of any substantial amount of gas or liquid to the atmosphere is avoided by utilizing gas from the storage tank to pressurize the transport tank, whereby liquid is forced from the transport tank to the storage tank, and then by utilizing gas from the transport tank to flush liquid from the liquid line into the storage tank. Preferably hose connections are used between the transport tank and the storage tank, and quick-disconnect couplings are provided on the ends of the hoses so that the hoses may be disconnected from the storage tank and the check valves built into such quick-disconnect couplings will close off both the hose side of the coupling and the tank side of the coupling and prevent the loss of either liquid or gas from the system.

In one embodiment of the invention means are provided for repressuring the storage tank by means of gas taken from the transport tank. The same conduits used for the liquid transfer operation are preferably used for the repressuring operation, with only changed connections or valving required.

Means are also provided, in one embodiment, for admission of gas from an external source into the system in order to obtain the necessary gas pressures for the operation of the system.

The design of the apparatus of the invention is such that it can be made very compact. The entire system can be carried in a small space on the back of a tank truck, and the system can be connected to the storage tank by merely making two quick hose connections. Time for delivery of the liquid is substantially reduced in the present system as compared to the systems previously used.

BRIEF DESCRIPTION OF THE DRAWING

The single figure of the drawing shows, somewhat schematically, one embodiment of the apparatus of the invention, with broken lines indicating alternative connections of conduits.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawing, a storage tank 10 is shown connected to a tank truck 12 through a system of conduits and a compressor 14. A hose 16 constitutes a portion of a gas line connected between the upper portion of the storage tank and a pipe 18, which is connected to the inlet end of the compressor 14. The hose 16 is preferably provided with quick-disconnect couplings 20 of a type well known in the art which include automatically closing valves, so that, upon release of a coupling 20, check valves close in both halves of the coupling to prevent flow outwardly from either the hose 16 or the storage tank 10.

A pipe 22 connected from the outlet of the compressor 14 leads to the transport tank 12. A pipe 24 connected to the bottom of the transport tank 12 and a hose 26 connected by means of a quick-disconnect coupling 20 to the pipe 24 constitute a liquid line, which is shown as being connected through another quick-disconnect coupling 20 to the storage tank 10.

It will be seen that conduit 18 is provided with a valve 28, and conduit 22 is provided with valves 30, 32 and 34. A crossover line 36 extends from conduit 22 between valves 32 and 34 to conduit 24 between valves 38 and 40 therein. Conduit 36 is provided with a valve 42.

Between alves 30 and 32 in conduit 22 a reverse flow line 44 intersects conduit 22. Line 44 is provided with a valve 46 therein.

As is shown in broken lines in the drawing, hose 16 may alternatively be connected to the end of conduit 44

rather than to the end of conduit 18, and hose 26 may be connected to the end of conduit 18 rather than to the storage tank 10.

In the embodiment shown in the drawing, another conduit 48 containing a valve 50 intersects line 18 for a purpose which will hereinafter be described.

In the ordinary operation of transferring mercaptans or other noxious liquids from a transport tank to a storage tank the hoses are connected to the storage tank in the manner shown in the drawing. Valves 28, 30, 32, 34, 38 and 40 are open, whereas valves 42, 46 and 50 are closed. The compressor is then started and gas from the top of tank 10 is transferred under pressure to tank 12. As soon as the pressure is high enough, liquid begins to flow through line 24 and hose 26 to the tank 10. Flow of the liquid continues until the tank 10 has been filled to the desired level. Then, in order to avoid the loss of any liquid to the atmosphere when the hose 26 is disconnected from the tank 10, the valve 38 is closed, the compressor is stopped, valve 32 is closed and valve 42 is opened. This causes the gas under pressure in the top of the transport tank to flow through crossover line 36 and hose 26 and purge the hose of liquid. When the hose has been purged of liquid, it may readily be disconnected from the storage tank with substantially no loss of any of the mercaptan or other noxious material to the atmosphere.

In many cases the storage tank must be maintained under a certain minimum pressure, and therefore it is necessary to repressure the storage tank after it has been filled with the liquid. Such repressuring is readily accomplished with the apparatus of the present invention by connecting the end of hose 26 to the end of conduit 18 and connecting hose 16 to the end of conduit 44. Then, with valves 32, 38 and 50 closed and all other valves open, the compressor is started and the gas is taken from the top of transport tank 12 through a portion of line 22, through crossover line 36, through a portion of line 24, through hose 26, line 18, another portion of line 22, line 44 and hose 16 into the top of storage tank 10.

In some instances it will be necessary to bring additional gas into the system. Such gas may for example be obtained from a gas pipeline or the like. Line 48 is provided here for such purpose. Thus, a quick-disconnect coupling and a hose may be attached to line 48 and to the source of additional gas. Then with valve 28 closed and valve 50 opened the compressor may take suction from this external source, either for pressurizing the transport tank 12 or for repressuring the storage tank 10.

It will be apparent to those skilled in the art that the various valves in the system may each be operated manually or may be connected for automatic operation to change as necessary for causing flow of liquid and gas in a desired manner. It will also be apparent that the precise arrangement of conduits and valves shown is not the only one that could be used to perform in the manner described. For example, additional bypass lines might be provided rather than requiring the movement of hoses 16 and 26 for alternative operation of the system. However, the preferred embodiment herein described has been found to be highly desirable in that it can be assembled very compactly so that the entire assembly can be carried in a small area on the back of the transport truck and connections to the storage tank are readily made for desired operations and transfer of materials.

The use of quick-disconnect couplings has been described herein as a preferred structure. However, it will be appreciated that other valving systems and connections at the ends of the hoses might be used and accomplish the same functions in substantially the same manner.

It has been demonstrated that the apparatus of this invention would allow the transfer of various noxious liquids from one container to another without the loss

of any substantial amount of material to the atmosphere even though the liquid may be a highly volatile one which must be kept under pressure to be kept liquid. When such volatile liquids are utilized the gas being transferred may be substantially a vapor of the liquid.

Although preferred and alternative embodiments of the invention have been herein shown and described, it is anticipated that equivalent elements might be substituted for many of the elements described and other arrangements of conduits and valves might be substituted to accomplish substantially the same purpose. Consequently, the invention is not limited to the precise embodiments described but only as set forth by the following claims.

I claim:

1. A method for transferring a liquid between conduit connected containers, comprising

pressuring a first container with a gas to a pressure sufficient to force a desired amount of liquid therefrom through a conduit into a second container, applying said pressurized gas to said liquid to force it through the conduit,

and then pumping gas through said conduit to remove substantially all liquid from said conduit.

2. A method as defined by claim 1 wherein the gas for pressuring the first container is taken from the second container, and the gas for removing liquid from the conduit is taken from the first container.

3. A method as defined by claim 1, followed by pressuring the second container with gas from the first container when the desired amount of liquid has been transferred.

4. A method for transferring an odorant material from a transport tank to a storage tank having a gas-filled space therein, comprising

connecting a gas conduit between the gas-filled space and the transport tank,

connecting a liquid conduit between the transport tank and the storage tank,

increasing the pressure in the transport tank and decreasing the pressure in the storage tank by transferring gas through the gas conduit, whereby the odorant material is caused to flow to the storage tank, through the liquid conduit,

stopping the flow of odorant through the liquid conduit, flowing gas from the transport tank through the liquid conduit into the storage tank to purge the liquid conduit of odorant,

and disconnecting the liquid and gas conduits from the storage tank.

5. A method as defined by claim 4 and including transferring gas into the storage tank to increase its pressure before the gas conduit is disconnected.

6. A method for transferring a volatile, noxious liquid from a first container to a second container, comprising pressurizing the first container to a pressure above the pressure in the second container,

forcing the liquid by means of said pressure through a line connecting said containers,

maintaining a sufficient pressure in said first container to cause the liquid to continue to flow through said line until the liquid reaches a desired level in the second container, by pressurizing a gas from said second container and pumping into said first container,

stopping the pressurizing of the first container, flowing the pressurized gas from the first container through said line to blow all liquid from the line and simultaneously raise the pressure in the second container.

7. Apparatus for transferring a volatile, noxious liquid from a first container to a second container, comprising a compressor,

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a first gas line from said compressor connected to said first container,
 a reverse flow line intersecting said first gas line,
 a second gas line adapted to be connected between the upper portion of said second container and alternatively the inlet of the compressor and the reverse flow line,
 a liquid line leading from the lower portion of the first container connectable to the second container, or alternatively to the inlet of the compressor when the second gas line is disconnected therefrom,
 a crossover line connected between the first gas line and the liquid line,
 and valve means positioned in said lines and operable to alternatively (1) allow gas flow from the second container through the second gas line, the compressor, and the first gas line into the first container, and to allow liquid flow through the liquid line from the first container to the second container; (2) allow gas flow through the crossover line and a portion of the liquid line into the second container; and (3) allow gas flow through the crossover line, a portion of the liquid line, the compressor, the reverse flow line and the second gas line into the second container.

8. Apparatus as defined by claim 7 wherein the second gas line and the liquid line include hoses having quick-disconnect couplings for connection to the second container.

9. Apparatus for transferring a liquid from a first container to a second container, comprising
 a compressor,

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first conduit means connectable with said containers and said compressor for transfer of gas from said second container to said first container,
 second conduit means connectable to transfer liquid from said first container to said second container, and third conduit means connectable to transfer gas from said first container to said second container through at least a portion of said second conduit means.

10. Apparatus as defined by claim 9 wherein said portion of said second conduit means comprises a hose with a quick-disconnect coupling for connection to said second container.

11. Apparatus as defined by claim 9 and including fourth conduit means connectable to transfer compressed gas to said second container.

12. Apparatus as defined by claim 11 wherein said fourth conduit means includes portions of said first, second and third conduit means.

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