SYSTEM FOR STORING A FLOWABLE MASS

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Filed: Apr. 17, 1973
Appl. No.: 352,080

Foreign Application Priority Data
Apr. 18, 1972 France 72,14371

U.S. Cl. 417/121, 417/122
Int. Cl. F04F 1/06, F04F 3/00
Field of Search 417/118, 120, 121, 122, 417/149, 137, 136, 132

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ABSTRACT

A system for the storage of a flowable mass, such as a liquid or a pulverulent solid, includes two storage units each with a closed vessel provided with a pair of three-way valves which are controlled by respective actuating levers. The two levers may be interconnected for joint swinging into a filling position, in which a supply of flowable mass communicates with a first conduit of an associated vessel while a second conduit thereof is vented, or into an emptying position, in which a source of high-pressure fluid communicates with the second conduit for expelling the contents of the vessel through the first conduit. Upon the decoupling of the two levers of one storage unit, the first lever may be placed in its filling position while the second lever is in its emptying position whereby the contents of the associated vessel can be transferred to the vessel of another storage unit through the supply conduit common to both units.

5 Claims, 3 Drawing Figures
SYSTEM FOR STORING A FLOWABLE MASS

BACKGROUND OF THE INVENTION

My present invention relates to a system for the storing and distribution, under pressure, of various gaseous, liquid or pulverulent products, wherein a closed storage vessel or tank is connected to a source of external driving fluid under pressure capable of expelling all or part of the contents of the storage vessel.

Although particularly intended for the distribution of liquid products, especially hydrocarbons, such installations can also be used for the storage and transfer of pulverulent or gaseous products.

The products stored can be subjected to pressure by a gas which is inert with respect to the product in question. It is thus possible, for example, to use nitrogen or carbon dioxide. Similarly, for other applications, use can be made of an auxiliary liquid which is enert with respect to the product to be transferred.

The use of such installations has been very limited, partly owing to the dangers involved in the presence of vessels under pressure and also owing to the necessity of recourse to complicated systems of taps and fittings, in order to obviate the risks due to incorrect operation.

The primary object of the invention is to provide a system of the aforementioned type which, by reason of its nature and design, will be of simple construction and easy to handle, in addition to satisfying the requirements of safety.

SUMMARY OF THE INVENTION

In accordance with the present invention I provide, in a system of the abovedescribed character, a plurality of storage units for a flowable mass capable of displacement by a high-pressure fluid, this mass being deliverable to a closed vessel in each unit through a supply conduit common to the several units. Each unit is connectable through a common high-pressure conduit to a source of driving fluid and is further provided with a discharge conduit for the flowable mass, a venting conduit for the driving fluid and first and second conduits leading to its vessel. A first three-way valve or cock is controlled by a first actuator, such as a lever, for alternately assuming a filling position and an emptying position respectively connecting the first conduit to the supply conduit and to the discharge conduit; a second three-way valve or cock is similarly controlled by a second actuator for alternately connecting the second conduit to the venting conduit in a filling position and to the high-pressure conduit in an emptying position. Thus, upon the joint placement of the two actuators in the filling position, a circuit is established from the supply conduit through the vessel to the venting conduit; upon their joint placement in the emptying position, a circuit is established from the source of driving fluid through the vessel to the discharge conduit. If the first actuator of a unit is in its filling position while the second actuator of the same unit is in its emptying position, a circuit is established from the source of driving fluid through the vessel of that unit to the common supply conduit whereby the contents of this vessel can be transferred to the vessel of another unit having its actuators in filling position.

In accordance with a more particular feature of my invention, the two actuators of each unit are provided with a detachable linkage for selectively interconnect-

ing same. By this means, the filling or emptying of a vessel in a storage unit requires but a single manipulation, so that these operations can be performed under optimum conditions from the point of view of safety.

Advantageously, pursuant to a further feature of my invention, the conduit communicating with the second cock and terminating near the top of the tank enters this latter at a level beneath the lower end of an additional conduit provided with a conventional pressure-relief valve.

This simple arrangement constitutes a safety device which minimizes the occurrence of fluid shocks in the conduits at the end of the filling operation, i.e., when the level of the product to be stored reaches the lower end of the conduit through which the high pressure fluid is evacuated.

BRIEF DESCRIPTION OF THE DRAWING

My invention will be described in greater detail with reference to the accompanying drawing in which:

FIGS. 1 and 2 are operating diagrams showing one storage unit of a system in accordance with the invention in the filling phase and in the discharge phase, respectively;

FIG. 3 is an operating diagram showing the different elements of the system during the transfer of the contents of the storage unit of FIGS. 1 and 2 to another storage unit

SPECIFIC DESCRIPTION

The system shown in the drawing two closed vessels tanks which may or may not be of the underground type served by a common supply station 3 and forming part of respective storage units, generally designated 4 and 4'. The two units being identical, I shall describe only unit 4 in greater detail. A first three-way cock 5 is capable of placing a conduit 7, whose lower end terminates in the vicinity of the bottom of the tank 2, in communication either with a feed conduit 8 for the fluid to be stored or with a discharge conduit 9.

A second cock 6 is capable of placing a conduit 10, whose lower end opens into the tank 2 near the top thereof, in communication either with an evacuation conduit 12 for a high-pressure driving fluid or with a conduit 13 connected to a source of that fluid, such as a gas reservoir 14. The conduit 13 contains in succession, starting from the gas reservoir 14, a stop cock 15, a high-pressure manometer 16, a relief valve 17, a calibrated nozzle 18, and a low-pressure stage consisting of a manometer 19, a safety valve 20 and an isolating gate 21. The conduit 13 also contains, upstream of the cock 6, a check valve 22.

The conduit 8, conveying the flammable mass from an inlet port 23 at the supply station to the first cock 5, contains an isolating gate 24, a check valve 25 and a discharge valve 26. Finally, a conduit 27, whose lower part terminates in the tank 2, contains a safety valve 28 capable of opening in the event of development of excess pressure in the tank.

The three-way cocks 5 and 6, which in principle could be sliding or rotating valves are arranged so that their actuating means can be temporarily coupled together for specific operations. In the embodiment shown in the drawing these cocks are of the rotatable type and are arranged back-to-back so that the axes of rotation of their rotatable elements are aligned. Furthermore, the rotatable element of each of these two
cocks is rotationally integral with one of the ends of a respective lever, 5a and 6a whose other end is detachably connected to a common operating handle 29.

In this manner, to move the rotatable elements of the two cocks 5 and 6 into their filling positions, in which the first cock 5 places the supply conduit 8 in communication with the conduit 7 while the second cock 6 places the conduit 10 in communication with the venting conduit 12, it is sufficient to swing the two gauged levers 5a and 6a from the position shown in broken lines in FIG. 1 to the position shown in full lines in the same Figure.

It should be noted that the conduit 27 penetrates for a certain distance d into the neck of the tank 2 while the conduit 10 is for a greater distance D.

Thanks to this relative staggering of the lower ends of these two conduits, the fluid shocks liable to occur at the end of the filling process are considerably reduced or even eliminated. As soon as the liquid reaches the level of the lower end of the conduit 10, which continues the filling operation, the gas compressed in the upper part of the tank by the arrival of the liquid still flowing in the conduits 8 and 7 forms a damping cushion communicating with conduit 27 and relief valve 28.

To withdraw stored fluid from the tank 2, it suffices to swing the levers 5a and 6a into the emptying positions shown in FIG. 2. In this case the first cock 5 places the conduit 7 in communication with the discharge conduit 9 while the second conduit 6 places the conduit 10 in communication with the high-pressure conduit 13 leading to the gas source 14.

The detachable connection 29 between the two levers 5a and 6a makes it possible to disconnect them from each other, particularly in order to enable the liquid contained in one storage unit (e.g. tank 2) to be transferred to another storage unit (e.g. tank 2') of the system. For this purpose, as shown in FIG. 3, it is sufficient to move the lever 5a controlling the cock 5 associated with the tank 2 containing the product to be transferred, into the filling position while its companion lever 6a is moved into the emptying position; the levers 5a' and 6a' of unit 2', including the receiving tank 2', are at the same time moved together into the filling position, being interconnected for this purpose by a linkage 29.'

In this manner the gas under pressure, passing through the conduits 13 and 10, enters the tank 2 and expels its contents, via the conduit 7, the cock 5, the conduit 8 and a branch 8' thereof to the cock 5' of the other storage unit 4' giving access to the conduit 7' of the tank 2'. At the same time the cock 6' of unit 4' enables the gas contained in the receiving tank 2' to escape through the conduits 10' and 12'. It should be noted that this operation is rendered possible only by the presence of the check valve 25 in the conduit 8, upstream of its junction with the branch 8'.

Although the installation has been described above in conjunction with its use for the discharge or transfer of a liquid under pressure of a gas, it is obvious that it can likewise be used to displace other flowable masses by various driving fluids, e.g., a primary liquid by an auxiliary liquid, a gas by an auxiliary liquid, or a putrefactive product by a gas or an auxiliary liquid.

Finally, this installation can be used for the storage of any liquid and particularly for that of fuels and of dangerous or toxic products.

My invention, of course is not limited to the specific embodiment which has been described above by way of an example but covers all equivalent systems within the scope of the appended claims.

1. A system for the storage of a flowable mass capable of displacement by a high-pressure driving fluid, comprising:
   a plurality of storage units for said flowable mass each including a closed vessel with a first conduit and a second conduit;
   a supply conduit for said flowable mass common to said units;
   a source of driving fluid provided with a high-pressure conduit for each of said units;
   a discharge conduit for said flowable mass at each of said units;
   a venting conduit for said fluid at each of said units;
   first three-way valve means at each of said units for connecting said first conduit thereof to said supply conduit in a filling position and to said discharge conduit in an emptying position;
   second three-way valve means at each of said units for connecting said second conduit thereof to said venting conduit in a filling position and to said high-pressure conduit in an emptying position;
   first actuating means for each of said units for alternately placing said first valve means thereof in said filling and emptying positions; and
   second actuating means for each of said units for alternately placing said second valve means thereof in said filling and emptying positions;
   joint placement of said first and second actuating means in said filling positions establishing a circuit from said supply conduit through the vessel to said venting conduit, joint placement of said first and second actuating means in said emptying position establishing a circuit from said source through the vessel to said discharge conduit, simultaneous placement of said first actuating means of one unit in said filling position and of said second actuating means of the same unit in said emptying position establishing a circuit from said source through the vessel of said one unit to said supply conduit whereby the contents of said vessel can be transferred to the vessel of another unit having said first and second actuating means in said filling position.

2. A system as defined in claim 1 wherein said supply conduit has branches leading to said units, further comprising a check valve in said supply conduit upstream of said branches.

3. A system as defined in claim 1 wherein both of said first and second actuating means of each unit are provided with a detachable linkage for selectively interconnecting same.

4. A system as defined in claim 3 wherein said first and second valve means for each of said units are provided with coaxial rotatable elements, said first and second actuating means being a pair of levers interconnectable by said linkage for joint swinging about the common axis of said elements.

5. A system as defined in claim 1 wherein for each of said units said first conduit terminates near the bottom of said vessel and said second conduit terminates near the top of said vessel, further comprising an additional conduit opening into said vessel above the termination of said second conduit, and pressure-relief means in said additional conduit for enabling the buildup of a fluid cushion in said vessel in said filling position.