May 29, 1928. 1,671,275

S. D. CLITHERO

TANK PRESSURE CONTROL

Filed June 6, 1927 2 Sheets-Sheet 1

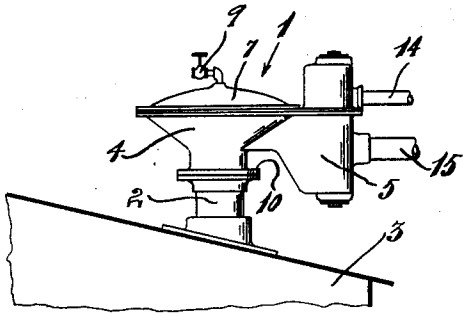


Fig. 1.

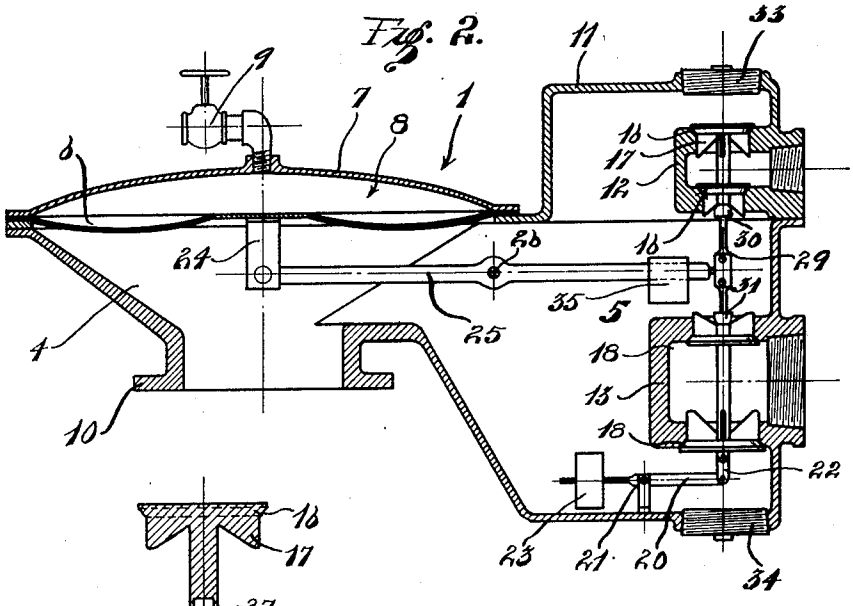


Fig. 2.

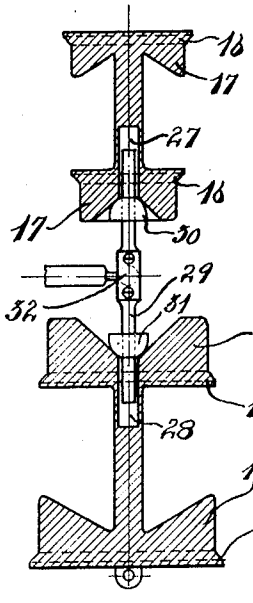


Fig. 3.

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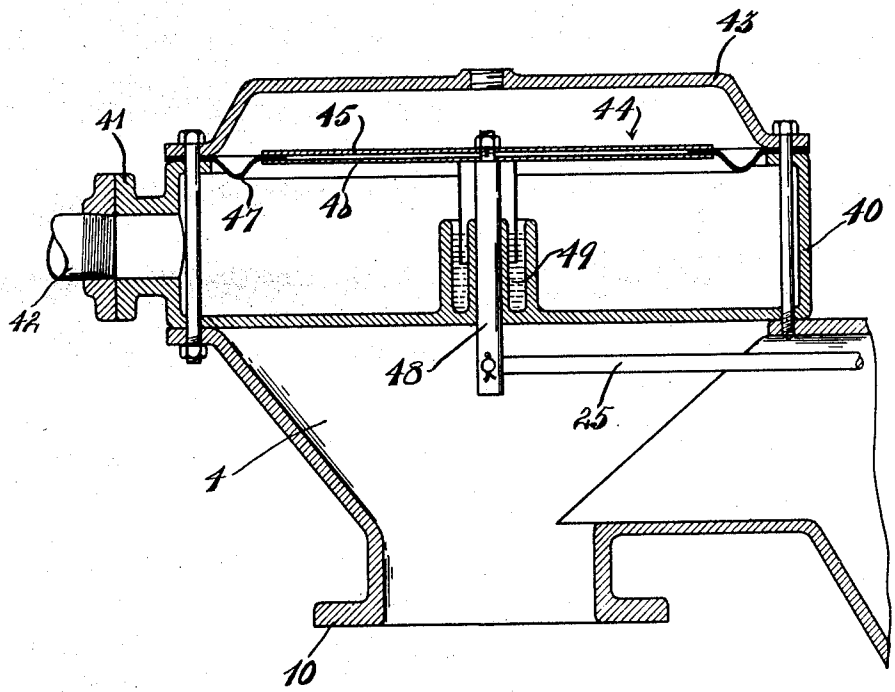
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Fig. 4.



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UNITED STATES PATENT OFFICE.

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TANK-PRESSURE CONTROL.

Application filed June 6, 1927. Serial No. 196,699.

In tanks containing volatile substances such as crude oil or the like, a space is left at the top thereof which space is filled with a gas. Due to the changes in temperature and the varying level of the fluid the pressure of this gas will change from time to time. It is very desirable that a constant pressure may be maintained on the fluid and in the tank in order that said tank will not be ruptured, and also minimize the vaporization of the volatile substances in the fluid.

An object of my invention is to provide an automatically controlled valve through which vapor pressure is maintained constant in the tank.

Another object is to provide a tank pressure control in which two valves are controlled from a single rod, said valves being operated at different pressures of the vapor in the tank.

A further object is to provide a tank pressure control which is simple in construction, inexpensive to manufacture and effective in operation.

A still further object is to provide a tank pressure control having two sets of valves operated from a single rod, each set being operable independent of the other.

Other objects, advantages and features of invention may appear from the accompanying drawing, the subjoined detailed description, and the appended claims.

In the drawing:

Fig. 1 is a side elevation of my control in position on a tank.

Fig. 2 is a transverse sectional view of my control.

Fig. 3 is a longitudinal sectional view through the two sets of valves.

Fig. 4 is a fragmentary transverse sectional view of a modified form of diaphragm chamber.

Referring more particularly to the drawing:

My tank pressure control 1 is adapted to be mounted on a suitable riser 2 extending from the top of a tank 3, said tank being adapted to contain a liquid of a more or less volatile nature. The space above the liquid in the tank is filled with a vapor and it's desirable that this vapor be held at a constant pressure. My pressure control is open to the tank and therefore is under the pressure of the vapor in said tank.

The control 1 comprises a diaphragm chamber 4 and a valve chamber 5. A diaphragm 6 of well-known and usual construction is positioned in the chamber 4 and is held in position by a cap 7, said cap being spaced from the diaphragm to provide an upper pressure chamber 8 the purpose of which will be further described. A valve 9 opens into the pressure chamber 8 and is adapted to control the pressure therein, as will be further described.

The control 1 is secured to the riser 2 by a flange 10, which flange is formed at the lower end of the diaphragm chamber 4. The diaphragm chamber 4 and valve chambers 5 are preferably integrally formed with a cover plate 11 secured to the top thereof. A pair of superposed valve cages 12, 13 are formed in the valve chamber 5 and a pressure pipe 14 extends into the cage 12, and a vacuum pipe 15 extends into the cage 13; that is, a vapor pressure is maintained on the cage 12 and a reduced pressure or vacuum is maintained on the cage 13.

A pair of superposed valves 16, 16 are positioned in the cage 12, said valves being spaced apart, and the pressure from the pipe 14 is exerted between them thus providing a balanced valve which will properly operate irrespective of the variation in pressure. Each of the valves 16, 16 are provided with depending guide wings 17, 17 which wings will properly guide the valves to their seat each time that they are lifted.

The lower valve cage 13 is provided with a pair of superposed valves 18, 18 similar in arrangement and construction to the valves 16 previously described. Upwardly extending wings 19, 19 guide said valves to their seat. The valves 16 are returned to their seat by gravity and the lower valves 18 are returned to their seat by a lever 20 pivoted as at 21 and connected to the valves 18 by a link 22. A counter weight 23 is provided on the free end of the lever 20, which counter weight is adjustable thereon, and by adjusting this counter weight the force necessary to lift the valves 18 can be varied.

A plate 24 depends from the diaphragm 6 and a control rod 25 is pivoted to said plate and is pivotally mounted at adjacent the center thereof on a pin 26. Vertical bores 27, 28 are formed in the valves 16, 18, respectively, and a bar 29 extends into both of said bores, said bar being free to slide in said

bores. Lugs 30, 31 are provided on the bar 29, said lugs being adapted to engage the valves 16, 18, respectively, to raise them from their seats as will be further described.

The end of the rod 25 is connected to the bar 29 by a ball and socket joint 32. Thus it will be seen that as the diaphragm 6 is flexed upwardly or downwardly the rod 25 will be swung correspondingly to lift the valves 16 or 18 from their seat. Only one of the valves are raised at a time since the bar 29 is free to move in the valves, consequently as the said bar moves upwardly the lug 30 engages the valve 16 to lift the same.

The counter weight 23 on the lever 20 holds the valve 18 on its seat. When the bar 29 moves downwardly the converse is true. In operation if the temperature should rise or if additional liquid is placed in the tank 3 thus increasing the pressure on the vapor above the liquid, this increase pressure being transmitted to the diaphragm 6 will cause said diaphragm to flex upwardly against the constant pressure in the chamber 8.

Upward movement of the diaphragm causes the rod 25 to swing, moving the outer end thereof downwardly thus moving the bar 29 downwardly and unseating the valves 18. The vacuum to which the pipe 15 is connected now draws the vapor out of the tank until the pressure has been sufficiently reduced so that the diaphragm 6 can again flex downwardly and the valves 18 are returned to their seat by the counter weight 23.

When the pressure is decreased in the tank by the withdrawing of fluid therefrom or a lowering of temperature, the diaphragm 6 will flex downwardly due to the constant pressure in the chamber 8 and this downward movement of the diaphragm swings the outer end of the rod 25 upwardly thus unseating the valves 16 and permitting the vapor under pressure from the pipe 14 to pass into the tank until a sufficient pressure has been placed therein to again move the diaphragm 6 upwardly and thus permit the valve 16 to close by gravity. It will be seen that the valves 16 are actuated at a point which is controlled by the pressure in the chamber 4 and by varying this pressure in the chamber the valves 16 are tripped at any desired pressure of the vapor in the tank.

The valves 18 are not entirely dependent upon the pressure in the chamber 4 but the adjustable counter weight 23 can be so arranged as to adjust the tripping of said valves to any desired point above the actual pressure in the chamber 8; that is, to unseat the valves 18 the diaphragm 6 must not only overcome the pressure in the chamber 8 but must also overcome the weight of the counter weight 23 or obviously this counter weight may also be adjusted so that its weight is removed from the diaphragm 6. Inspection plugs 33, 34 are provided in my control, which plugs give access to the valves 16, 18, respectively, to permit inspection and repair of the same.

Another function of the chamber 8 and valve 9 is to prevent chattering of the diaphragm 6 while the vapor is flowing through the cages 12, 13 in the following manner.

The valve 9 may be opened any desirable amount thus restricting the emission of the gas from the chamber 8 and preventing the rapid movement or chattering of the diaphragm. In this latter case the actuation of the valve 16 is entirely dependent upon the variation in pressure of the vapor in the tank, since there is practically no pressure exerted on the top of the diaphragm by the gas in the chamber 8. As previously stated the only function of this chamber is to prevent the chattering of the diaphragm and the consequent chattering of the valves. The valves 18 are adjusted by means of the counter weight 23 as previously stated. It is obvious that if desired a counter weight may be placed on both of the valves 16, 18, or instead of the counter weight a spring or other seating means may be employed.

If desired the counter weight 35 may be provided on the arm 25, said counter weight being movable thereon and provides an effective means of counteracting the movement of the diaphragm 6 so as to provide a better balance between the valves 16, 18 and the diaphragm. By this means I can more perfectly balance the valves 16, 18 without counter weighting the same, and said valves may be adjusted to open at any desired pressure in the tank.

In Fig. 4 I have shown a slightly modified form of diaphragm control in which a hollow casting 40 is secured over the diaphragm chamber 4. The casting 40 is provided with a flanged coupling 41 into which a pipe 42 extends, said pipe leading from the tank 3. Thus it will be seen that the variation of pressure in the tank 3 will be transmitted to the hollow casting 40. A cap 43 is secured over the casting 40 and a diaphragm 44 is positioned between the cap 43 and casting 40. This diaphragm comprises a pair of plates 45, 46 between which a flexible fiber strip 47 is secured, the ends of this strip being secured between the cap 43 and casting 40. By this arrangement I provide a diaphragm which has a large movement and the center of which is flexed, thus enabling the post 48 to move upwardly or downwardly in a vertical line.

A well 49 is provided around the post 48 said well being filled with mercury, or the like, and provides a seal to prevent the passage of gas from the casting 40 into the chamber 4. The rod 25 as previously de-

scribed is pivotally mounted on the post 48 and the operation of the valves (not shown) is identical to that previously described.

An advantage of this arrangement is that the rush of gas through the chambers 4, 5 will in no way affect the operation of the diaphragm, said diaphragm being separated from these chambers and is actuated only by the pressure in the tank 3.

Having described my invention, I claim:

1. A tank pressure control comprising a diaphragm, a pair of valves, one of which controls a pressure line and the other a vacuum line, a bar extending between said valves, operable means connecting said bar and said diaphragm, and a counter weight on one of said valves.

2. A tank pressure control comprising a diaphragm, a pair of superposed valves, one of said valves controlling a pressure line and the other a vacuum line, a counter weight on the lower valve, and operable means connecting said valves to the diaphragm.

3. A tank pressure control comprising a diaphragm, a pair of superposed valves, one of said valves controlling a pressure line and the other a vacuum line, a bar extending between said valves, and a single rod extending from said bar to the diaphragm whereby either of said valves may be actuated.

4. A tank pressure control comprising a diaphragm, a pair of superposed valves, one of said valves controlling a pressure line and the other a vacuum line, a bar extending between said valves, and a single rod extending from said bar to the diaphragm whereby either of said valves may be actuated, and a counter weight on the lower valve.

5. A tank pressure control comprising a diaphragm, a pressure chamber above the diaphragm, a pair of superposed valves, a bar extending between said valves and slidable therein, a pivotally mounted rod secured to said diaphragm and said bar whereby either of said valves are adapted to be actuated by the diaphragm.

6. A tank pressure control comprising a diaphragm, a pressure chamber above the diaphragm, a pair of superposed valves, a bar extending between said valves and slidable therein, a pivotally mounted rod secured to said diaphragm and said bar whereby either of said valves are adapted to be actuated by the diaphragm, lugs on said bar adapted to engage the valves to unseat the same, a pivotally mounted lever connected to the lower valve, and a counter weight adjustably mounted on said lever.

7. A tank pressure control comprising a diaphragm chamber and a valve chamber in said diaphragm chamber, a pressure chamber above the diaphragm, a valve on said pressure chamber, a pair of superposed cages in said valve chamber, valves in said cages, each comprising a pair of superposed valve heads, the upper cage being connected to a pressure line and the lower cage being connected to a vacuum line, a bar extending between said valves and being slidable therein, lugs on the bar adapted to engage the valves to unseat the same, and a pivotally mounted rod connected to said bar and to the diaphragm.

8. A tank pressure control comprising a diaphragm chamber and a valve chamber in said diaphragm chamber, a pressure chamber above the diaphragm, a valve on said pressure chamber, a pair of superposed cages in said valve chamber, valves in said cages, each comprising a pair of superposed valve heads, the upper cage being connected to a pressure line and the lower cage being connected to a vacuum line, a bar extending between said valves and being slidable therein, lugs on the bar adapted to engage the valves to unseat the same, and a pivotally mounted rod connected to said bar and to the diaphragm, a lever pivotally mounted in said valve chamber, a link connecting said lever and the lower valve, a counter weight adjustably mounted on said lever, and inspection plugs in said valve chamber.

9. A tank pressure control comprising a diaphragm plate connected with the tank and movable by the varying pressure in the tank, a pair of valves one of which controls a pressure line and the other a vacuum line, a bar extending between said valves, operable means connecting said bar and said diaphragm plate, and a counter weight means on said valves.

In testimony whereof, I affix my signature.

STANLEY D. CLITHERO.