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LIQUID AND FLUID CONTROL

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2 Sheets-Sheet 1

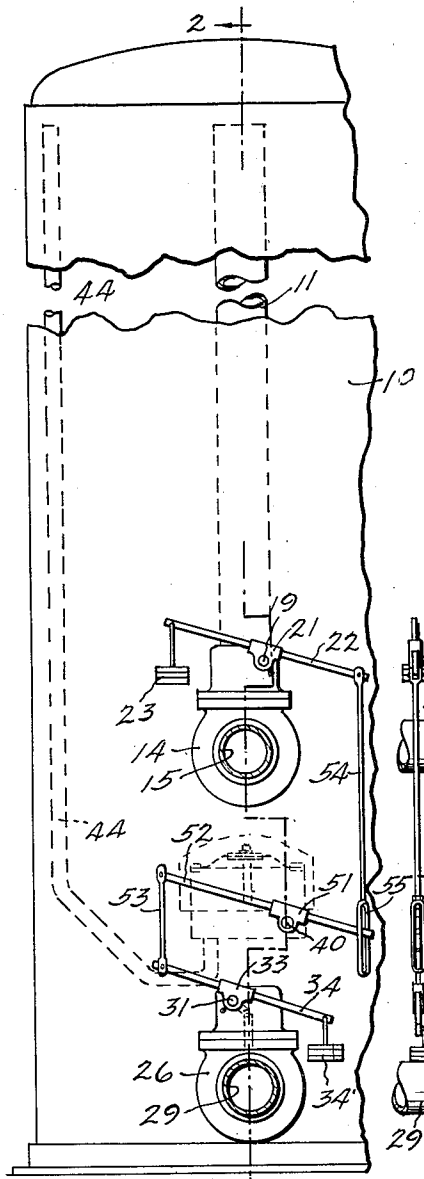


Fig. 1

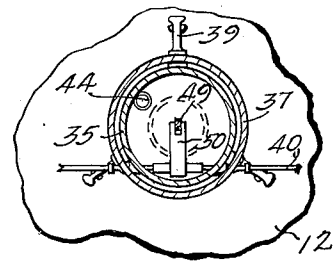


Fig. 3

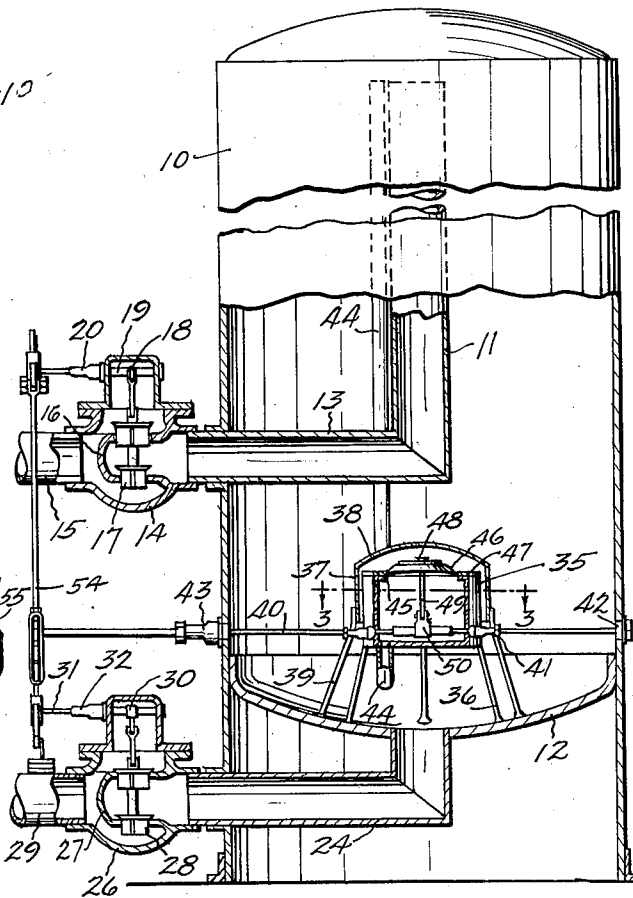


Fig. 2

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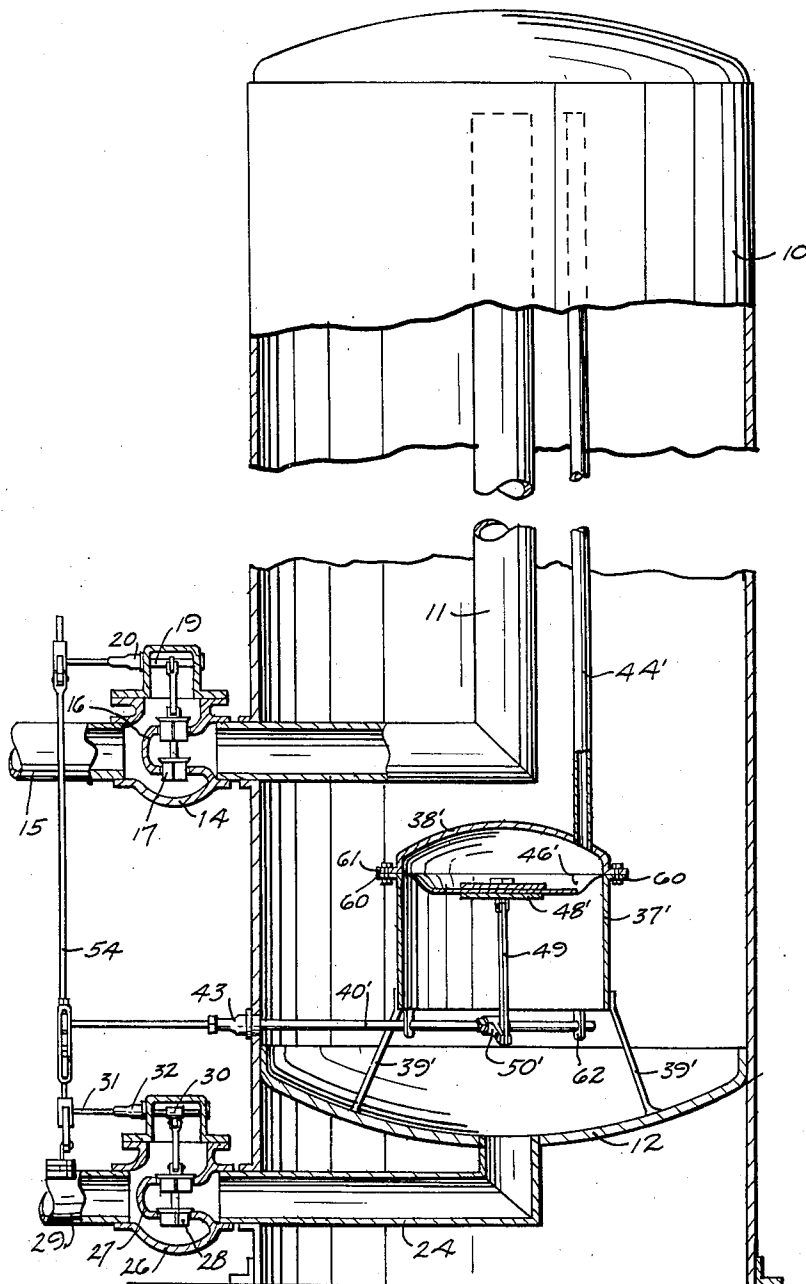
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LIQUID AND FLUID CONTROL

Application filed January 26, 1931. Serial No. 511,304.

This invention relates to new and useful improvements in liquid and fluid controls.

One object of the invention is to provide an automatic control device for the gas outlet and the liquid outlet valves of a container, wherein an improved form of diaphragm is employed and the gas pressure and the specific gravity of the liquid utilized.

A further object of the invention is to provide a diaphragm shielded from the direct weight of the liquid, but subject to actuation by variances in the weight of the liquid induced by its rise and fall within the container, together with means for equalizing the gas pressure on one side of the diaphragm and on top of the liquid.

Another object of the invention is to provide a diaphragm-operated device immersed in the liquid within the container for operating a rock shaft, whereby the gas and liquid outlet valves are actuated on the exterior of the container.

A construction designed to carry out the invention will be hereinafter described together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings in which an example of the invention is shown, and wherein:

Figure 1 is a partial elevation of a tank equipped with a control device constructed in accordance with the invention,

Figure 2 is a view at right angles to Figure 1, partly in elevation and partly in section,

Figure 3 is a horizontal cross-sectional view taken on the line 3—3 of Figure 2, and

Figure 4 is a view similar to Figure 2 showing another form in which the invention may be carried out.

In the drawings the numeral 10 designates an upright tank having a false bottom 12. A gas discharge pipe 11 extends upwardly in the tank and a lateral pipe 13 extends through the side of the tank well above the bottom and is connected into one side of a gas valve casing 14 from the other side of which a gas pipe 15 extends. The gas valve

is of the usual construction common in this art and forms no particular part of the invention. It is shown as a double valve having therein a bonnet 16 carrying the valve seats for the valves 17, which are suspended in the usual manner from the crank 18, as is shown in Figure 2.

The crank is fastened on a rock shaft 19 extending through a packing box 20, as is shown in Figure 2. On the outer end of the shaft is fastened a collar 21 which has a lever 22 adjustably secured therein. From one end of the lever weights 23 are suspended, and these weights counterbalance the valves, as will hereinafter be described.

An oil discharge pipe 24 leads from the false bottom 12 through the side of the tank. The outer end of the pipe 24 is fastened into the casing 26 of an oil outlet valve similar to the valve 14. The casing 26 has a bonnet 27 connected with the pipe 24 and carrying the valve seats for receiving the valves 28. A discharge pipe 29 leads from the bonnet of the casing. The valves are suspended from the end of a crank 30 fastened on the end of a rock shaft 31 within the casing. The shaft 31 extends through a stuffing box 32 and has a collar 33 fastened on its outer end in the usual manner. The collar 33 receives a lever 34 which with the lever 22 is connected with the operating means to be hereinafter described.

It will be seen that so long as the valves 28 are closed no oil can escape from the tank and a predetermined oil level may be carried. The gas valves 17 are shown in Figure 2 as partially opened. This permits a limited escape of gas from the pipes 11 and 13. It is obvious that if the gas valves were set to carry a pressure of twenty-five pounds in the separator, an excessive gas pressure in the tank could not be relieved unless the valves were further opened, and also that if the gas valves are entirely closed any desired gas pressure (within safe limits) may be built up in the tank. By arranging the oil valves 28 to open in advance of any change in the position of the gas valves, an excess of oil in the tank may be discharged without disturbing the adjustment of the

gas valves or altering the gas pressure. Should the oil rise to an excessive height the gas valve would be further closed to build up more gas pressure to expel the oil.

5 It will be noted by observing Figures 1 and 2, that when the lever 22 is rocked in a counter-clockwise direction the gas valves 17 will be closed and when the lever 34 is likewise rocked the oil valves 28 will be
10 opened, the said levers extending in opposite directions. Automatic means for operating these valves form the basis of this invention.

Within the tank 10 I mount a vertical
15 cylindrical drum 35 supported above the bottom 12 on legs 36 at the center of said tank. A cylindrical shield 37 having a dome 38 surrounds and overhangs the drum, being spaced therefrom. The shield is also sup-
20 ported on legs 39.

A rock shaft 40 extending horizontally of the tank penetrates the drum 35 and passes through stuffing boxes 41 on each side of said drum, whereby the latter is made gas tight.
25 One end of the shaft is journaled in a bearing cap 42 screwed into the side of the tank. The shaft extends through the opposite side of the tank and also through a stuffing box 43 on the outside of the tank.

A gas pipe 44 leading from the top of the tank 10 enters the bottom of the drum and supplies gas thereto. The drum has an inner annular flange 45 on its upper end on which a diaphragm 46 is secured by a retaining ring 47. A clamp 48 is secured to the diaphragm. A link 49 pivoted to the clamp hangs in the drum. The lower end of the link is pivoted to the outer end of a crank 50 fastened on the rock shaft 40.

35 When liquid supplied to the tank rises to a level above the dome 38 of the shield 37, air will be trapped under the dome and above the diaphragm. Consequently the liquid will be confined to the annular vertical space between the shield and the drum and will act against the trapped air, using the latter as a ram to depress the diaphragm 46. Liquids and sand entering the tank would fall directly on the diaphragm 46 if it
45 were not for the dome 38. When the valves 28 are fully opened the oil or liquid level will be below the level of the diaphragm. It is desirable to have the diaphragm operate free from impact from the inflowing
50 liquids and sand. The gas pressure from the upper part of the tank will be exerted by the gas supplied to the drum, against the underside of the diaphragm 46, thus supporting the same, but not resisting the
55 depression of the diaphragm.

A collar 51 is fastened on the outer end of the shaft 40 and receives a lever 52. A link 53 has its upper end pivoted to one end of the lever 52, while its lower end is pivoted
60 to the end of the lever 34 opposite to the

weighted end. An elongated link 54 pivoted at its upper end to one end of the lever 22 has a loop 55 on its lower end receiving the lever 52. The rock shafts 19 and 31 together with the elements 22, 54, 52, 53 and 34 constitute valve actuating means; while the shaft 40 acts as a common operator for such elements.

It will be seen that the weight 34' will act to resist the downward displacement of the diaphragm 46 by the weight of the liquid within the tank. Whenever the specific gravity of the liquid is increased by an excess of liquid above the normal level within the tank and this increase in specific gravity is sufficient to overcome the weight 34', the diaphragm 46 will be displaced downwardly, due to the liquid in the space between the shield 37 and drum 35 compressing the air in the dome 38. The gas pressure on top of the liquid and under the diaphragm will be equalized through the pipe 44 and while the pressure of the gas will tend to support the diaphragm, it will not resist its operation. The downward depression of the diaphragm 46 will rock the shaft 40 in a counter-clockwise direction (Figure 1), whereby the levers 34 and 52 will be likewise swung. Owing to the loop 55 the lever 22 of the gas valves 14 will not be disturbed during the initial swing of the lever 52.

From the foregoing it will be seen that an excess of liquid, such as oil in the tank, will cause the oil valves 28 to open and release this excess without disturbing the gas valves 17. When the gas valves 17 are partially open, as shown in Figure 2, they will be so held by the pressure of the gas which is escaping through the pipes 11 and 13. This pressure will be sufficient to overcome the counter-balancing weight 23. Whenever this pressure drops below the predetermined point, the said weight 23 will swing the lever 22 and close the gas valves until the pressure is again built up in the tank. By adding or removing weights, the operation of the valve 17 may be controlled.

It is customary in oil and gas separators for which this control is particularly designed, to set the gas valve so that it will not open except at a pressure considerably higher than is ordinarily necessary to force out the oil through the outlet valve. This is done so that should the well head or suddenly increase its flow, sufficient gas pressure will be present in the tank to force out the excess of oil. There are conditions under which even this excess of gas pressure may cause a failure, such as when the oil is cold and stiff in cold climates and does not run freely, or where considerable sand collects in the pipes and partially fills them. To carry this excess excess pressure is very undesirable because it results in a greater agitation of the oil under normal condi-
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tions and escapes with the oil into the storage tanks. The more the oil is agitated, the greater is the loss of gaseous vapors and the more the grade of the oil is reduced.

5 By the use of the control herein set forth, it is only necessary to carry about one-third the gas pressure in the tank as is ordinarily employed and further because of the positive operation, pipes of smaller diameters
10 may be used. As before explained, the oil level in the tank may rise to a certain extent without disturbing the adjustment of the gas valves 17, but causing the oil valves 28 to open. The maintained gas pressure in
15 the tank will be sufficient to force out the excess of oil and restore the normal level.

However, should the well head up so as to produce an excess of oil above a normal flow, not only would the valves 28 be further opened, owing to the increase in the
20 specific gravity or weight of the liquid within the tank, but the continued rocking of the shaft 40 would cause the lever 52 to engage the top of the loop 55 and further close
25 the gas valves 17. The result would be that additional gas pressure would be built up within the tank sufficient to force out the abnormal amount of oil.

On the other hand, if the excess in the
30 tank was gas and not oil, it would overcome the counter-balancing weight 23 and further open the valves 17 without disturbing the oil valves, and thus relieve the excessive gas pressure. This arrangement
35 permits a minimum amount of gas pressure to be carried in the tank at all times and the control is entirely automatic in its operation. It often happens that the gas pipe
40 15 is connected with a gasoline plant and a vacuum is pulled through said pipe. It is quite common to use floats for operating the oil outlet valve and a tendency of the suction created by the vacuum is to raise
45 the oil level in the tank with the result that the oil level rises to the point where it overflows into the gas outlet pipe, which is not only detrimental but dangerous, and results in great losses at the gasoline plant. This
50 cannot happen where the controls herein described are used.

While air will be trapped in the shield 37, such air may be so compressed as to permit the liquid to actually contact the diaphragm. It is pointed out that the cross-sectional area of the space between the drum 35 and the shield 37 is greater than the cross-sectional area under the dome 38 and across the diaphragm in order that the full applied force engendered by the weight of the
60 liquid may be utilized in operating the diaphragm.

In Figure 4 I have shown a preferred form in which the invention may be carried out. A shield 37' similar to the shield 37
65 is mounted on legs 39' and is provided at

its top with an outwardly directed flange 60. A circular diaphragm 46' is clamped on the flange 60 by the annular flange 61 of a dome 38'. The flanges are suitably fastened together. The shield and dome in
70 this form not only protect the diaphragm but provide a storage chamber for the gas above the diaphragm.

A clamp 48' is secured to the center of the diaphragm and a depending link 49 has
75 its upper end pivoted thereto. The lower end of the link is pivoted to a crank 50' fastened on the rock shaft 40', which operates like the shaft 40 and is substituted therefor. The shaft 40' is journaled in ears 80 62 hanging from the bottom of the shield. The stuffing boxes 41 are eliminated. A gas pipe 44' leads from the dome 38' to the upper portion of the tank, otherwise the parts are the same as in the other figures of
85 the drawings.

This form operates in the same manner as the first form except that perhaps a greater volume of air will be trapped under the diaphragm and this will somewhat cushion the operation of the diaphragm. The gas pressure above the diaphragm and on top of the liquid will be equalized. This form is more simple and less expensive to construct and will be less likely to get out
95 of order.

It is pointed out that if the link 54 was omitted the liquid valves 28 would be operated just the same by the diaphragm and therefore the invention is not to be limited to the operation of both valves by the diaphragm.
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While the invention has been described in connection with an oil and gas separator, it may be otherwise used wherever it is desired to release liquid and gas from a container, the term gas being used as a generic term for air, gas or the like.
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Various changes in the size and shape of the different parts, as well as modifications and alterations, may be made within the scope of the appended claims.
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Having illustrated and described preferred forms of the invention, what I claim, is:
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1. The combination with a tank, of a liquid outlet valve connected with the tank, a gas outlet valve connected with the tank, a shield in the tank having its bottom open to the liquid, a diaphragm in the shield exposed to the liquid, a gas chamber above the diaphragm, means for supplying gas from the tank to the chamber to equalize the gas pressure on top of the diaphragm and on top of the liquid, a rock shaft connected with the diaphragm, and operating connections between the shaft and the valves.
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2. The combination with a tank, of a liquid outlet valve connected with the tank, a gas outlet valve connected with the tank, a
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shield mounted in the lower portion of the
tank having its top closed and its bottom
open for receiving liquid from the tank, a
diaphragm in the shield, a gas chamber on
5 one side of the diaphragm, means for sup-
plying gas from the tank to said chamber to
equalize the gas pressure on the diaphragm
and on top of the liquid, a rock shaft mount-
ed in the tank, a rocking connection between
10 the diaphragm and the shaft, and an op-
erating connection between the shaft and
the valves.

In testimony whereof I affix my signature.

ELMER R. WILLIAMS.

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