Feb. 14, 1933.

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1,897,745

VALVE CONTROLLING MEANS

Filed May 15, 1931

3 Sheets-Sheet 1

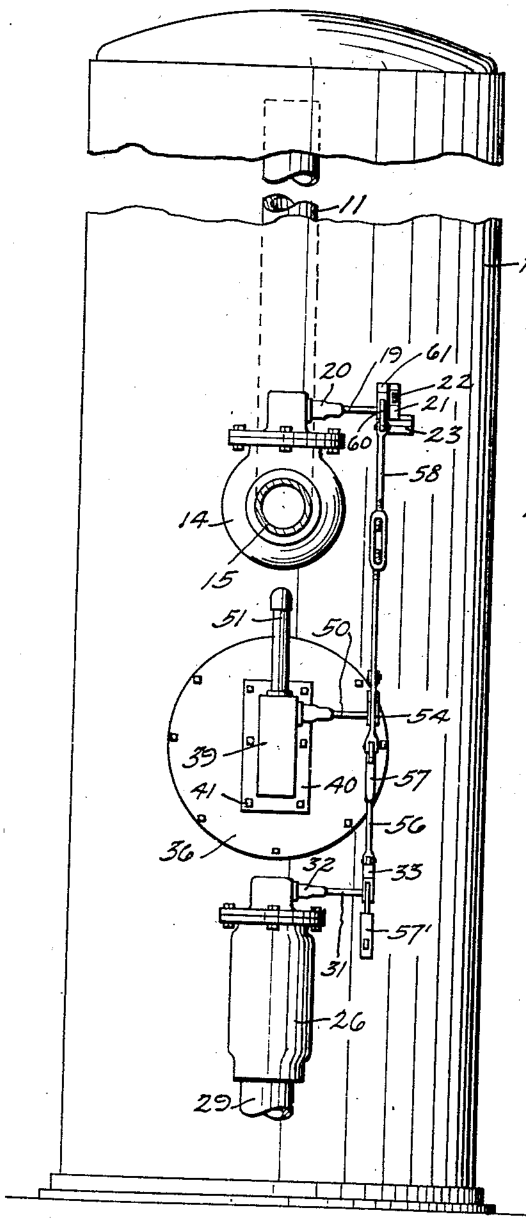

Fig. 1

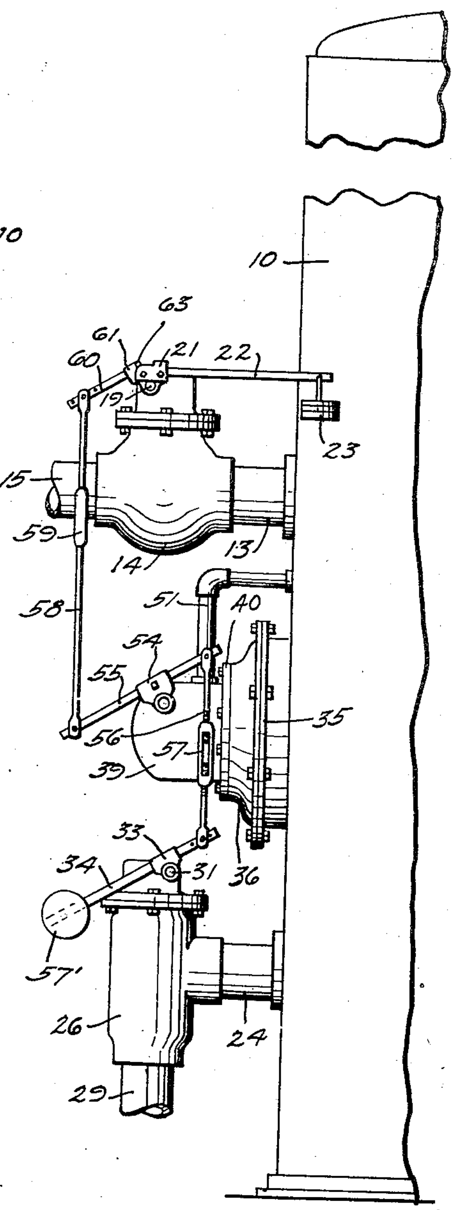

Fig. 2

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3 Sheets-Sheet 2

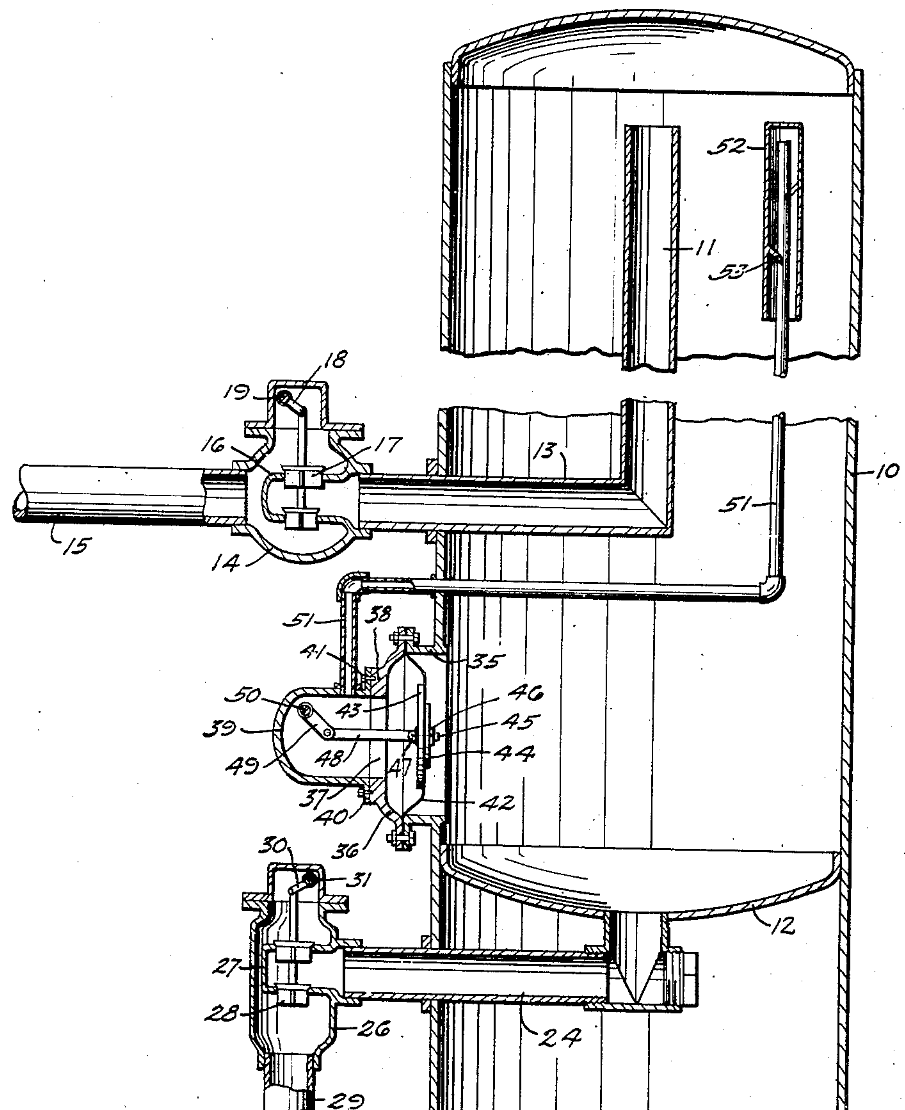

Fig. 3

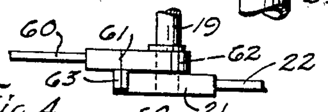

Fig. 4

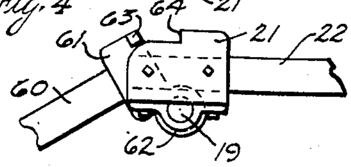

Fig. 5

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VALVE CONTROLLING MEANS

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3 Sheets-Sheet 3

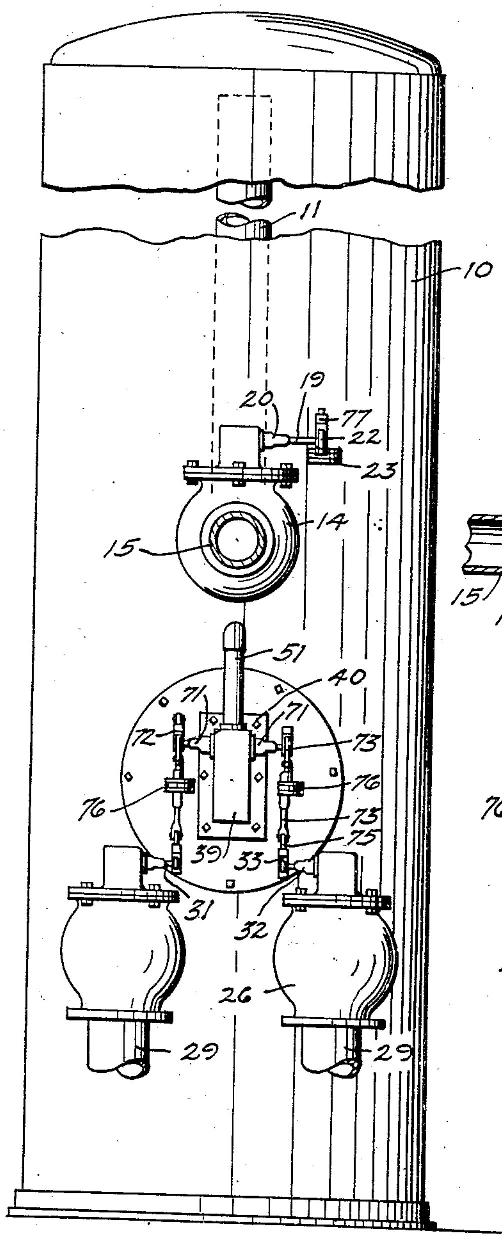

Fig. 6

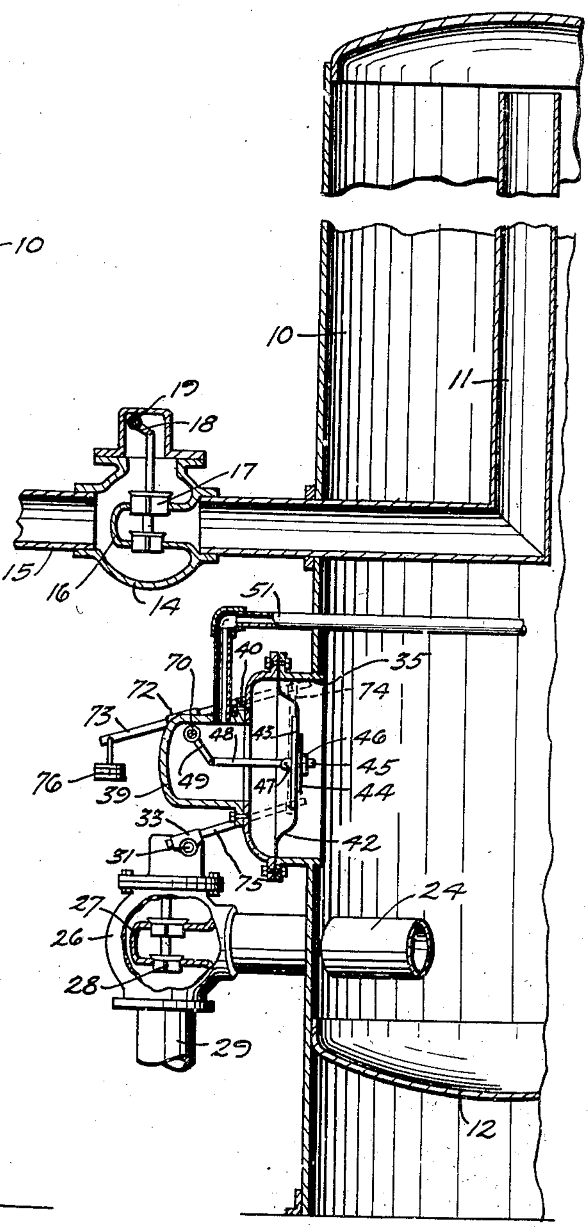

Fig. 7

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UNITED STATES PATENT OFFICE

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VALVE CONTROLLING MEANS

Application filed May 15, 1931. Serial No. 537,559.

This invention relates to new and useful improvements in valve controlling devices.

One object of the invention is to provide improved means for controlling the outlet of gases and liquids from a container.

Another object of the invention is to provide improved means for automatically operating the liquid outlet valve without operating the gas outlet or independently of said gas outlet.

A further object of the invention is to provide a coupling device, whereby independent movement of the gas valve is permitted and also whereby the gas valve will be operated by the automatic means after a predetermined initial operation of said automatic means.

Still another object of the invention is to provide a controlling device arranged to be inserted through and mounted on a manhole.

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 an elevation of a container equipped with a control device constructed in acordance with the invention,

Figure 2 is a partial side elevation of the same,

Figure 3 is a vertical sectional view of said container and device,

Figures 4 and 5 are details of the gas valve coupling,

Figure 6 is an elevation of a container equipped with a modified form of control device, and

Figure 7 is a partial vertical sectional view of the same.

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 3.

The crank is fastened on a rock shaft 19 extending through a packing box 20, as is shown in Figure 1. A box 21 is clamped on the outer end of the shaft and a lever 22 has one end fastened in the box. A counter weight 23 is suspended from the outer end of the lever. The weight tends to swing the lever downward and close the valves 17, which are forced open by the gas from the pipe 13. These valves are of the type in common use on oil field separators, the upper valve being larger than the lower valve. By varying the weight 23 the head gas pressure in the tank may be maintained at the desired point.

A liquid or 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. Both of these valves may be of the double balance type, quite common in the art 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 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.

A suitable distance above the false bottom 12 a flanged man-hole collar 35 is secured in the side wall of the tank 10 in the usual manner. It is customary to equip separator and other tanks with a man-hole in the lower side wall thereof. Instead of the usual man-hole cover I provide a dished cover 36 which is bolted to the flange of the collar 35. The cover 36 has a central vertical rectangular opening 37 surrounded by a boss 38.

A bonnet 39 fits the opening and has a lateral base flange 40 fastened on said boss by stud bolts 41. The annular edge portion of a flexible diaphragm 42 is clamped between the flanges of the collar and the cover. This diaphragm may be made of any material suitable for the purpose. I have found rubberized fabric to give excellent results, but other flexible or resilient materials may be used.

A circular supporting plate 43 is mounted concentrically on the outer side of the diaphragm, while a smaller clamp disk 44 is placed against the inner side of the diaphragm within the collar 35 and exposed to the liquid in the tank. A bolt 45 extending through the plate, diaphragm and disk is secured by a nut 46. This bolt has ears 47 formed on its head and one end of a link 48 is pivoted therein. The outer end of the link is pivoted in the lower end of a crank arm 49 which is fastened on a rock shaft 50 journaled in the bonnet.

It will be noted that the entire inner side of the diaphragm (the disk 44 being considered a part of the diaphragm) is exposed to the liquid in the tank. To prevent collapsing of the diaphragm and to equalize the pressure on both sides a gas vent pipe 51 extends from the upper portion of the tank down through the side wall and into the bonnet 39. An elongated cylindrical hood 52 is mounted on the upper end of the vent pipe and contains baffles 53. This hood keeps out liquid, but admits gas.

A collar 54 is fastened on the outer end of the shaft 50 and a lever 55 is fastened in said collar intermediate its ends. A link 56 including a turn buckle 57 is pivoted to the inner end of the lever 55 and connects with the lever 34 of the liquid outlet valve. A counterweight 57′ is mounted on the outer end of the lever 34.

A link 58 including a turn buckle 59 has its opposite ends pivoted to the outer end of the lever 55 and an arm 60. The arm 60 (Figures 2, 4 and 5) is fastened in a rocker 61 which has a collar 62 journaled on the shaft 19. The rocker carries a laterally projecting lug 63 which overhangs the box 21, the latter having a stop lug 64 in the path of the lug.

It will be seen that the shaft 19 may rock a limited distance without the shoulder 64 engaging the lug 63 and thus the gas pressure may open and close the gas valves 17 without interfering with the control device. The arm 60 may be swung upward a limited distance without disturbing the gas valves, thus permitting the liquid valves 28 to open and close without disturbing the gas valves.

As before stated herein, the entire inner side of the diaphragm 42 is exposed to the liquid in the tank. It will be seen that the weight 57′ will act to resist outward displacement of the diaphragm and normally this weight holds the liquid valves 28 closed. Whenever the liquid in the tank builds up to such a height as to produce sufficient weight against the diaphragm to overcome the weight 57′ and its leverage, the diaphragm 42 will be displaced outward.

It is necessary to use a relatively large diaphragm and expose the entire (or substantially so) inner area to the liquid in order that the force generated by the weight of the liquid may be applied directly to the area of said diaphragm. The height of the liquid and the direct application of the weight are necessary elements. The reason for this is that the diaphragm must be quick and positive in its action so that a sudden volume of liquid discharged into the tank will open the valves 28 without waiting to build up a pressure. Exposing the diaphragm to liquid conducted to it by a pipe of smaller diameter has been tried and will not produce the quick and positive action necessary.

The outward movement of the diaphragm will rock the shaft 50 and by means of the pipe 51 the gas pressure on opposite sides of the diaphragm will be equalized, therefore said pressure will not resist the movement of the diaphragm. The rocking of the shaft 50 will swing the lever 55 and its links 56 and 58. The link 56 will swing the lever 34 in opposition to the weight 57′.

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 valves 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, 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 pressure is very undesirable because it results in a greater agitation of the oil under normal conditions 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.

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 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 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 abnormal quantity of oil above the normal flow, not only would the valve 28 be opened as usual, but the further displacement of the diaphragm 42 would further open said valves. The continued rocking of the shaft 50 past the normal limit would cause the link 58 to swing the arm 60 high enough to engage the lug 63 with the shoulder 64, whereby the shaft 19 would be rocked and the gas valves 17 thus closed. The result would be that no oil could escape into the gas pipe 15 and sufficient gas pressure would be built up in the tank to force out the abnormal amount of oil through the oil valve.

On the other hand, if the excess in the 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 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 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 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 cannot happen where the controls herein described are used.

The weight 57′ on the lever 34 assures closing of the liquid valves 28 as well as restoring the diaphragm 42 to its inoperative position. The coupling between the arm 60 and the lever 22 is a more positive connection than other forms and permits of more flexible adjustments. The mounting of the diaphragm control on the man-hole 35 and its cover 36 makes for simplicity, convenience, accessibility and economy in manufacture.

In Figures 6 and 7 I have shown the control device operating two liquid outlet valves and not connected to the gas valve. It will only be necessary to describe the structures which are different and the same reference numerals will be used for parts which are the same as previously described. Instead of the shaft 50 the crank arm 49 is attached to a rock shaft 70 extending through stuffing boxes 71 on each side of the bonnet 39. Collars 72 are fastened on the ends of the shaft and receive levers 73.

Each lever has a weight 76 hung on its outer end, while its inner end is connected to the upper end of a link 74. The collar 33 of each outlet valve receives a lever 75 pivoted to the lower end of one of the links 74. When the liquid level in the tank reaches the proper height to operate the diaphragm 42, both outlets will be opened by operating the valves 28 thereof, thus giving a double discharge of liquid.

The usual back pressure valve is employed between the gas pipes 13 and 15, except that the lever 22 is connected to a regular collar 77 fastened on the shaft 19. With the double liquid outlet the danger of the liquid rising into the gas pipes is reduced to a minimum.

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.

Having illustrated and described preferred forms of the invention, what I claim, is:

1. In a valve controlling device, an upright tank having a man-hole in its side portion, a collar surrounding said man-hole, a cover secured on the collar, a flexible diaphragm secured between the cover and the

collar, a bonnet on the cover open to the diaphragm, a rock shaft journalled in the bonnet, a crank arm on the shaft connected to the diaphragm, a liquid outlet valve connected to the tank, a gas outlet valve connected to the tank, and valve operating connections connected with the valves and the rock shaft.

2. A valve controlling device as set forth in claim 1, and a gas equalizing pipe extending from the bonnet into the tank.

3. In a valve controlling device, an upright tank having a man-hole in its lower side portion, a collar surrounding said man-hole, a cover on the collar, a flexible diaphragm secured between the cover and the collar, a bonnet on the cover open to the diaphragm, a rock shaft journalled in the bonnet, a crank arm on the shaft connected to the diaphragm, a pair of liquid outlet valves connected to the tank, levers on the rock shaft, operating levers on the valves, and means for connecting the shaft levers with the valve levers.

4. In a valve controlling device, an upright tank having a man-hole in its side portion, a collar surrounding said man-hole, a cover secured on the collar, a flexible diaphragm secured between the cover and the collar, a bonnet on the cover open to the diaphragm, a rock shaft journaled in the bonnet, a crank arm on the shaft connected to the diaphragm, a liquid outlet valve connected to the tank, a gas outlet valve connected to the tank, and valve operating connections connected with the liquid outlet valve and the rock shaft.

In testimony whereof I affix my signature.

ELMER R. WILLIAMS.