Feb. 5, 1957 E. E. WESTMORELAND 2,780,231

AUTOMATIC TANK SWITCHING DEVICE

Filed Nov. 26, 1954 3 Sheets-Sheet 1

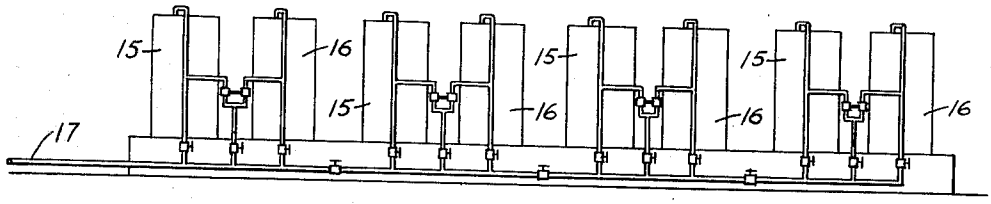


FIG. 1

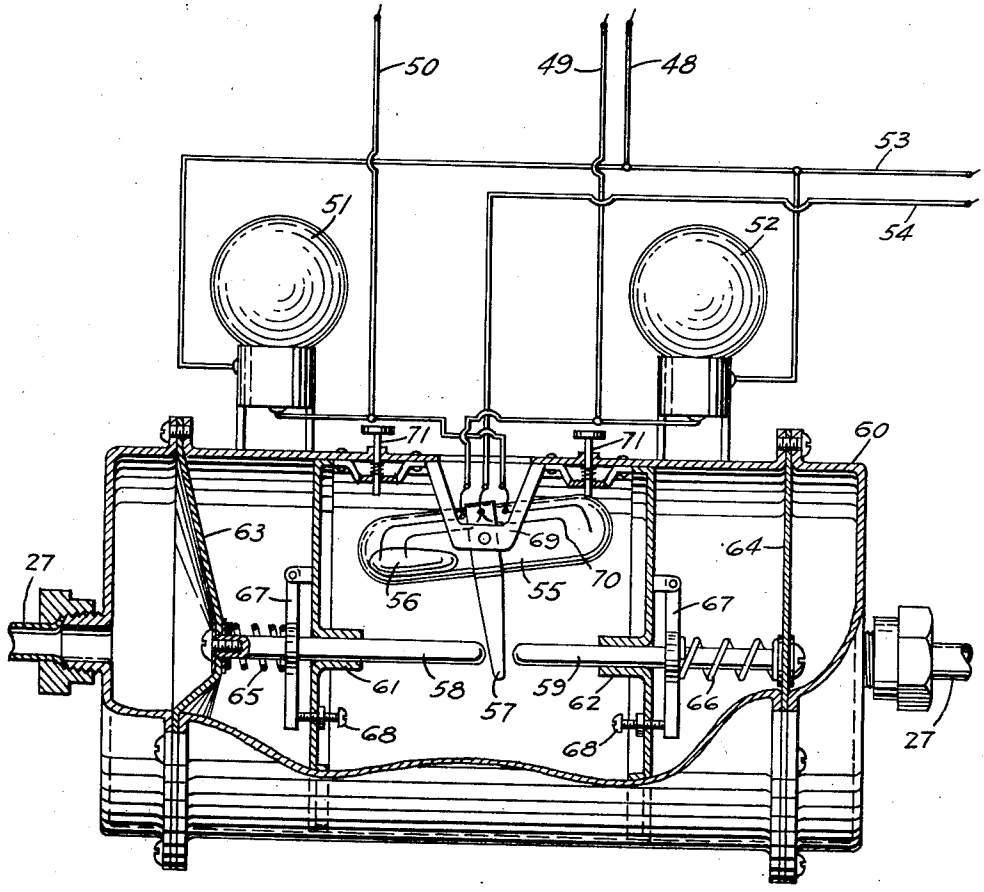


FIG. 5

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AUTOMATIC TANK SWITCHING DEVICE

Filed Nov. 26, 1954 3 Sheets-Sheet 2

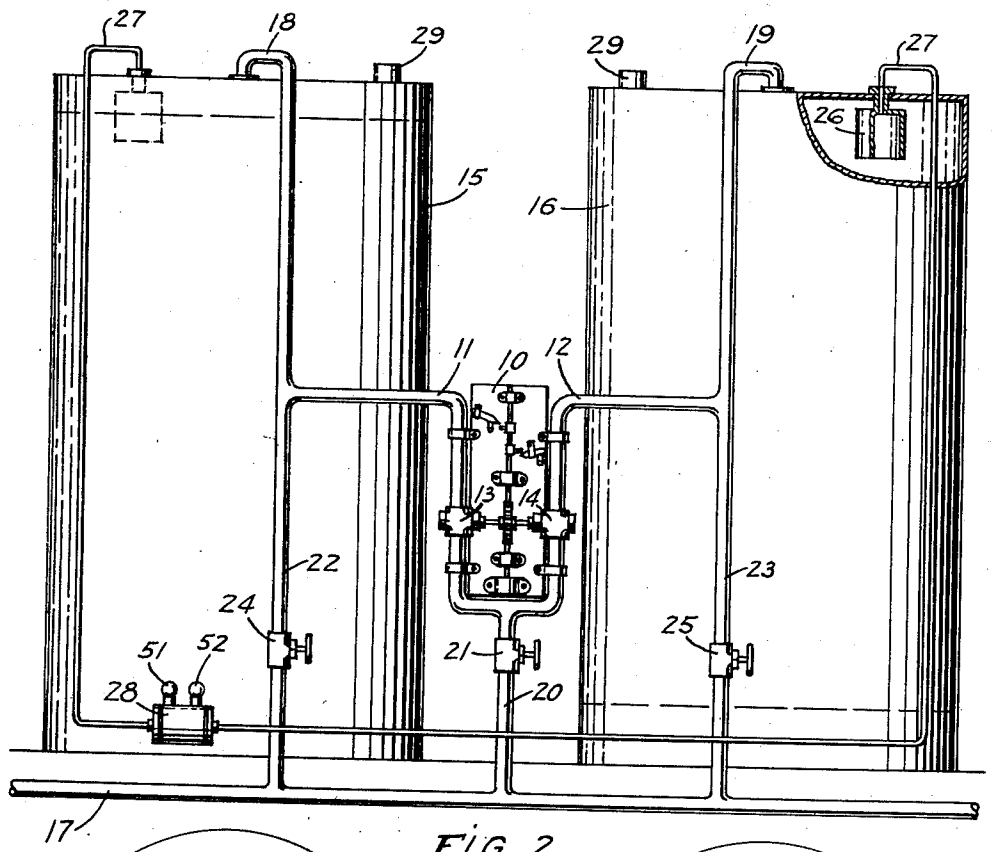


FIG. 2

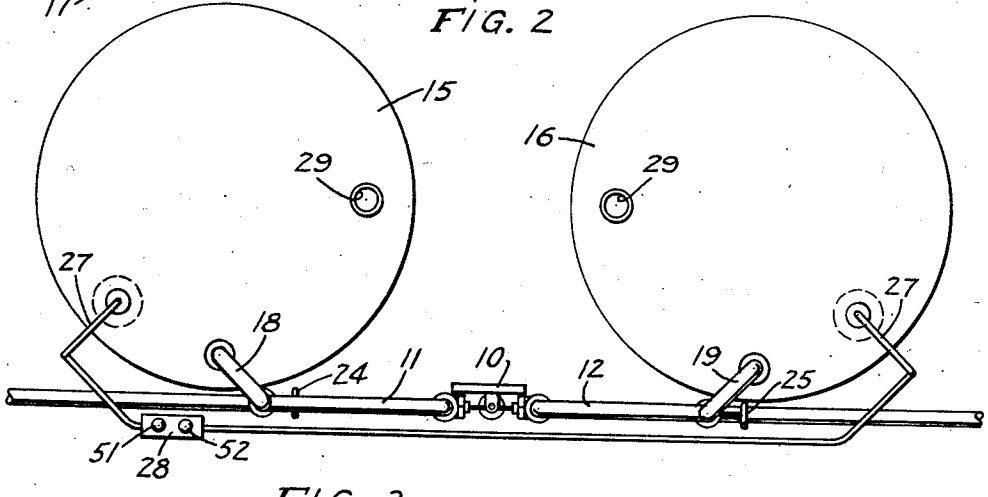


FIG. 3

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Feb. 5, 1957 E. E. WESTMORELAND 2,780,231

AUTOMATIC TANK SWITCHING DEVICE

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3 Sheets-Sheet 3

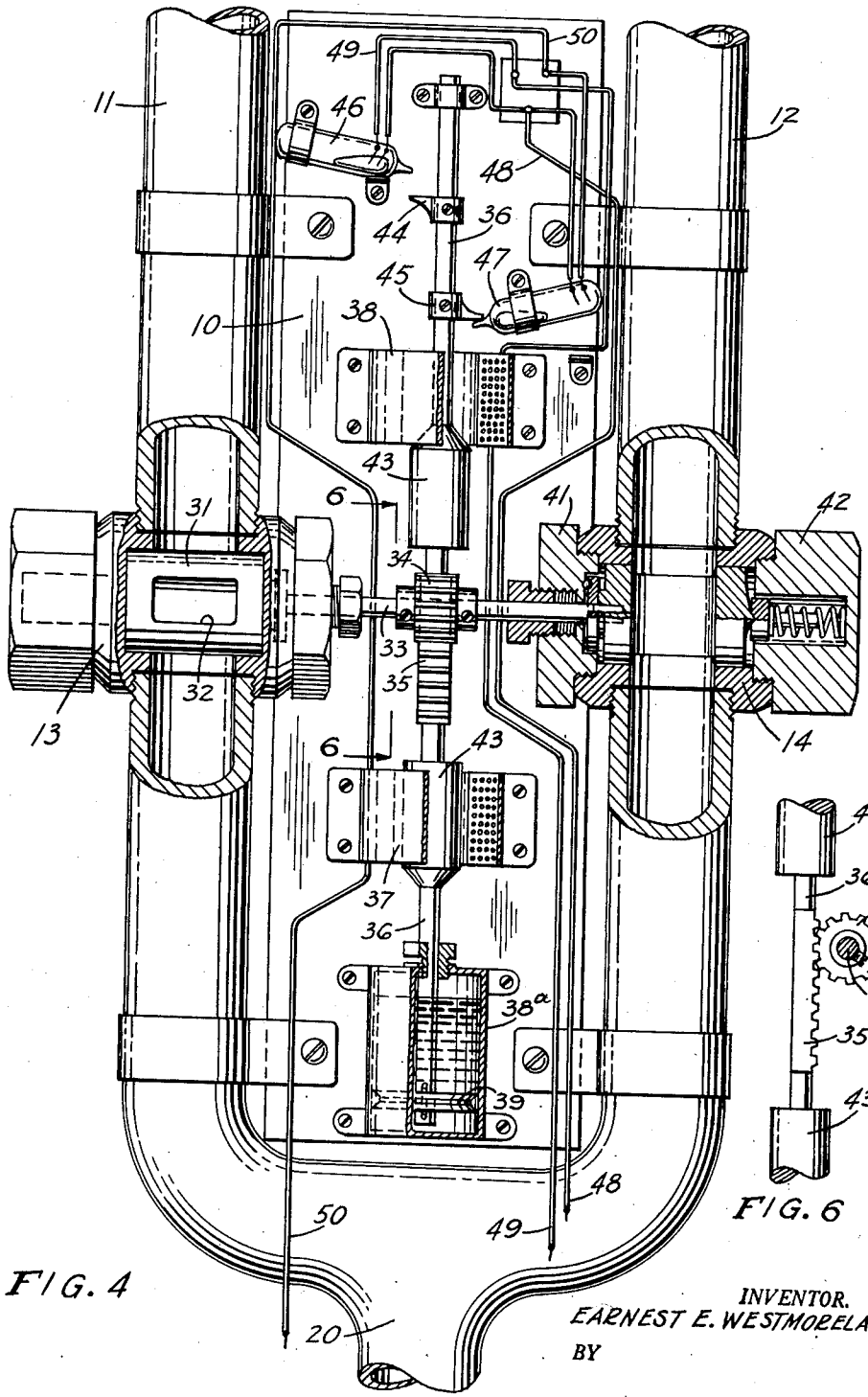


FIG. 4

FIG. 6

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AUTOMATIC TANK SWITCHING DEVICE

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Application November 26, 1954, Serial No. 471,223

2 Claims. (Cl. 137—121)

The present invention relates to pumping systems generally and specifically to a device for switching the input of fluid from one tank to another in a pair of tanks.

The primary object of the present invention is to provide a switching device for controlling the flow of fluid into either one of the pair of tanks which switching device operates automatically when the fluid reaches a certain level within either of the tanks.

Another object of the present invention is to provide a tank switching device having a pressure generating means located at a position within the tank operable by the rise of liquid within the tank and a pressure responsive means controlling a motor which operates the valves to shut or close the conduit leading to the tank.

A further object of the present invention is to provide a new and novel switching device responsive to the rise of liquid within a tank to control a valve in the conduit leading to the tank, which switching device includes a diaphragm operated double pole, double throw switch.

A still further object of the present invention is to provide an automatically operated switching device for controlling the flow of fluid into a pair of tanks, with indicating means showing which tank is being filled, so that pairs of tanks may be used in a series with the present invention connected to each pair of tanks for a successive filling of the series of tanks.

These and other objects and advantages of the present invention will be fully apparent from the following description when taken in connection with the annexed drawings, in which:

Figure 1 is a somewhat schematic view of a series of tanks arranged in pairs with the present invention connected to each pair of tanks,

Figure 2 is a plan view in elevation of a pair of tanks with the present invention located between them and connected to each of them,

Figure 3 is a top view showing the tanks and the present invention as in Figure 2,

Figure 4 is a detailed view of the valves and the motor means for operating the valves of the present invention,

Figure 5 is a side view in cross section of the switching means of the present invention, and

Figure 6 is a detailed view on line 6—6 of Figure 4.

Referring in greater detail to the drawings in which like numerals indicate like parts throughout the several views, the invention provides a panel **10** disposed between and secured to a pair of conduits **11** and **12** in which are disposed the valves **13** and **14**, respectively.

As seen in Figures 1 to 3, tanks **15** and **16**, arranged in a pair, may be a part of a series of tanks, all of them connected to a supply line **17** by means of which liquid is conveyed from a source of liquid under pressure. The tanks **15** and **16** are storage tanks and have outlet connections not here shown nor described as not being a part of the invention. The outlet connections of each of the tanks may lead to refineries if used in the oil industry, or may be otherwise arranged and used as desired.

Each of the tanks **15** and **16**, have inlets **18** and **19**, respectively, connected to the conduits **11** and **12**, respectively. An inlet conduit **20** is connected to both of the valves **13** and **14**. A shutoff valve **21** is provided in the inlet conduit **20**, and other inlet conduits **22** and **23** are provided for the tanks **15** and **16**, respectively, with valves **24** and **25** provided to close the input of liquid into each of the tanks from the source of liquid under pressure independently of the operation of the valves **13** and **14** or the single valve **21**.

As shown in cross section and in dotted lines in Figure 2, the tanks **15** and **16** are provided with a pressure generating means consisting of an open-ended cylinder **26** having its open end disposed downwardly and having its closed end secured to the top of the tank with a conduit for air **27** connecting the open-ended cylinder **26** to a control housing **28**.

Air vents **29** are provided for each of tanks **15** and **16** to release the air as fluid is pumped into it through the inlets **18** and **19**, respectively. Each of the valves **13** and **14** are provided with a rotary element **31** which has a slot **32**. The rotary element **31** of each of the valves is movable through 90° from a position opening its associated conduit or closing its associated conduit, the slots **32** being disposed relative to each other so that the pair of valves are movable from a position in which one valve is open and the other closed to a position in which the one valve is closed and the other open.

A drive shaft **33** connects both of the valves and carries a spur gear **34** which is engageable with the rack gear **35**.

As shown most clearly in Figures 4 and 6, the rack gear **35** is part of a shaft **36** reciprocatingly mounted between two solenoids **37** and **38**. The shaft **36** projects beyond the solenoid **37**, the lowermost one of the two, into a dash-pot arrangement consisting of a cylinder **38***a* and a piston **39** on the shaft **36**, the piston **39** being movable upwardly and downwardly within the cylinder **38***a* to provide cushioning and resistance which yields slowly to the reciprocating motion of the shaft **36**.

Suitable gland nuts **41** and **42** are provided for each of the valves **13** and **14**, as seen in cross section in Figure 4 relative to the valve **14**.

The shaft **36** carries the magnetic elements **43** which move the shaft in response to current flowing through either of the solenoids **37** and **38**. The upper end of the shaft **36** carries the limit stops **44** and **45** which move with the shaft to engage the free ends of the pivotally mounted mercury switches **46** and **47**, respectively.

The mercury switch **46** is connected in circuit with the solenoid **38**, and the switch **47** is connected in circuit with the solenoid **37** to stop the movement of the rack gear **35** at the limit of its travel.

The circuits connecting the solenoids **37** and **38** and the switches **46** and **47** include a common ground wire **48** and the wires **49** and **50**.

Referring to Figure 5, the common ground **48** is shown connected to each of the lamps **51** and **52**, and to a wire **53** leading to a source of current, the other wire of which, as indicated by the reference numeral **54**, leads to the center connection of a double pull, double throw cercury switch **55**.

The wires **49** and **50** are connected to the other terminal of the lamps **52** and **51**, respectively, and to the opposite lead wires of the mercury switch **55**, and as shown in Figure 5, the pull mercury **56** is seen to be closing the circuit including lamp **52** and wire **49** together with the common ground wire **48**. In Figure 4, this closed circuit will be seen to consist of the switch **46** and the solenoid **37**. In the condition shown in Figure 4, the rack gear **35** has closed valve **13** and opened the valve **14**. The lamp **52** being lit, this would indicate that the tank **16** is being filled while the inlet **18** into the tank **15** is closed. The double pole double throw mer-

cury switch 55 has an actuating arm 57 engageable by either of the push rods 58 or 59, or both. The housing 60, in which the push rods 58 and 59 are journalled in partitions 61 and 62, respectively, also contains the diaphragms 63 and 64, one at each end, and operatively connected to each of the push rods 58 and 59, respectively.

The diaphragms 63 and 64, with the end walls of the housing 60 form chambers which are connected by each of the conduits 27, one to the tank 15 and the other to the tank 16. Springs 65 and 66 serve to return each one of the diaphragms 63 and 64, respectively, to their original position after pressure from the cylinder 26 of the associated tank has been removed.

A lever 67 and an adjusting screw 68 are connected to the lever in each of the partitions 61 and 62 for adjusting the tension of the springs 65 and 66, respectively.

While it is seen that the mercury switch 55, as pivotally supported on the bracket 69 may act as an overcenter switch to close either of the pair of circuits, it also will act to open both of the circuits when the diaphragms 63 and 64 are both subject to equal pressures from their pressure generating means in their respective tanks. The push rods 58 and 59, in a case like that, would center the actuating arm 57. If the contacts, indicated generally by the reference numeral 70 in Figure 5, were so disposed within the mercury switch 55 with respect to the amount of mercury, the centering of the actuating arm 57 would open both of the circuits. This would turn off both of the lights or lamps 51 and 52, indicating to the operator that both of the tanks were full to the top. Push buttons 71 are used to change the flow from one tank to the other when it is desirable to do so.

Other electrical controls and signals may be incorporated within the system here described, which is only intended to alternatingly fill one of two tanks in a series of pairs of tanks, which tanks are emptied by means (not shown) for the purposes of refining oil, treating liquids, or the like.

While only a single embodiment of the present invention has been here illustrated and described, it is believed that other embodiments may be made and practiced within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. In a pumping system having a pair of tanks to be filled from a source of liquid under pressure, the improvement consisting in providing automatic switching means for alternatingly filling said tanks, said means comprising a pair of conduits each connected to a source of fluid under pressure and connected one each to each of said tanks, a valve disposed in each of said conduits, a rotatable drive shaft interposed between said valves and connecting said valves together so that said valves move from a position in which one of said valves is open and the other closed to a position in which said one valve is closed and the other open, another shaft mounted for reciprocatory movement positioned transversely of said drive shaft and connected to said drive shaft so as to impart its reciprocatory movement as rotational movement to said drive shaft, a pair of solenoids operatively connected to said another shaft for effecting its reciprocatory movement, pressure responsive means operatively connected to said solenoids adapted to be actuated when the liquid reaches a predetermined level therein and operable to energize one of said solenoids and cause movement of said another shaft for effective movement to the closed position of the one of said valves associated with one of said tanks in which the liquid reaches a predetermined level, and pressure generating means connected to each of said tanks and operatively connected to the solenoid controlling the adjacent valve adapted to be actuated by the liquid in either of said tanks when the liquid in said tank reaches a predetermined level.

2. In a pumping system having a pair of tanks to be filled from a source of liquid under pressure, the improvement consisting in providing automatic switching means for alternatingly filling said tanks, said means comprising a pair of conduits each connected to a source of fluid under pressure and connected one each to each of said tanks, a valve disposed in each of said conduits, a rotatable drive shaft interposed between said valves and connecting said valves together so that said valves move from a position in which one of said valves is open and the other closed to a position in which said one valve is closed and the other open, another shaft mounted for reciprocatory movement positioned transversely of said drive shaft and connected to said drive shaft so as to impart its reciprocatory movement as rotational movement to said drive shaft, a pair of solenoids operatively connected to said another shaft for effecting its reciprocatory movement, pressure responsive means operatively connected to said solenoids adapted to be actuated when the liquid reaches a predetermined level therein and operable to energize one of said solenoids and cause movement of said another shaft for effective movement to the closed position of the one of said valves associated with one of said tanks in which the liquid reaches a predetermined level, and pressure generating means connected to each of said tanks and operatively connected to the solenoid controlling the adjacent valve adapted to be actuated by the liquid in either of said tanks when the liquid in said tank reaches a predetermined level, said pressure responsive means including a housing, a pair of diaphragms disposed in said housing, one of said diaphragms being movable in response to the pressure generated in the pressure generating means associated with one tank and the other being movable in response to the pressure generated in the pressure generating means associated with the other tank, a double pole double throw switch operable to energize said motor means for alternate movement of said valves to each position, and means at said housing connected to said diaphragms for actuation of said switch to energize one of said solenoids for movement to the closed position of the one of said valves associated with the one of said tanks in which the liquid has reached a predetermined level.

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