April 4, 1950 J. I. McDANIEL 2,502,578

LIQUID LEVEL CONTROL DEVICE

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FIG. 1.

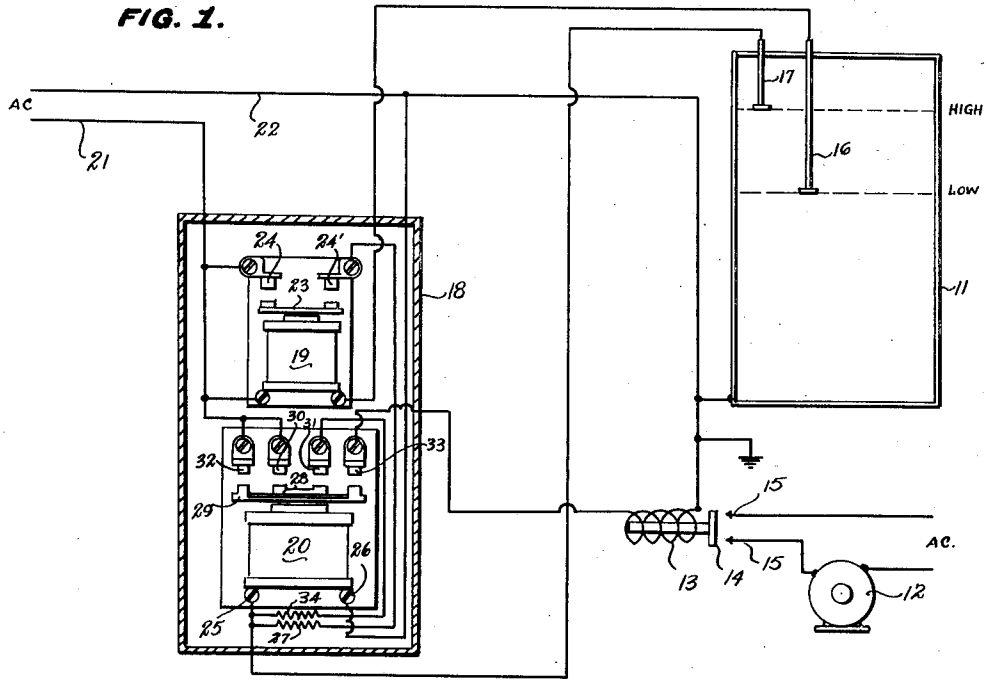
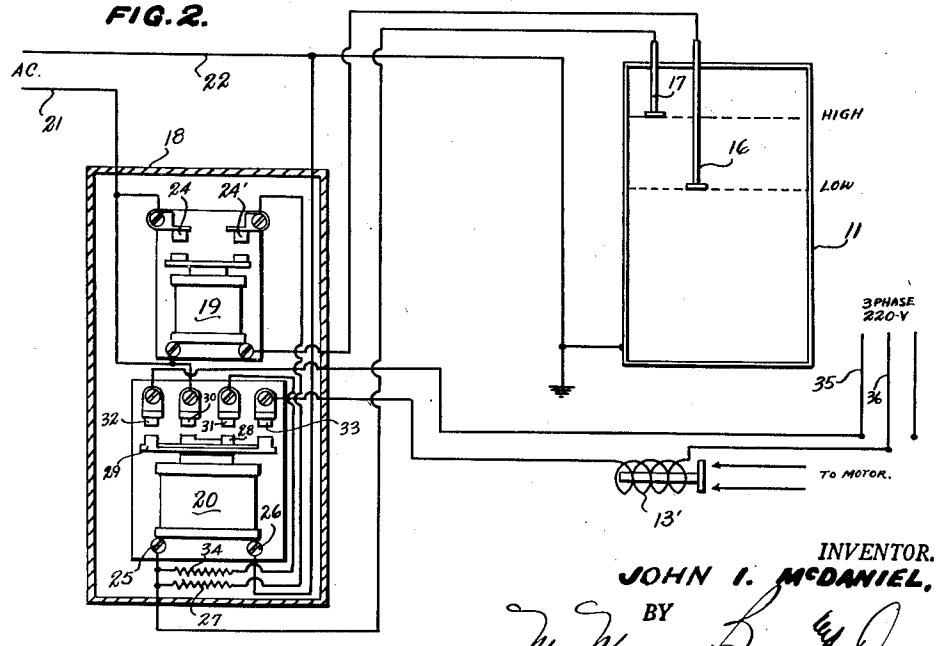


FIG. 2.



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LIQUID LEVEL CONTROL DEVICE

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3 Claims. (Cl. 175—335)

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This invention relates to liquid level control devices, and more particularly to electrical level control devices.

A main object of the invention is to provide a novel and improved level control device for maintaining the liquid in a container between a predetermined high level and a predetermined low level, said device being very simple in construction and dependable in operation.

A further object of the invention is to provide an improved liquid level regulator for liquid containers, said regulator being inexpensive to manufacture, easy to install and very efficient in operation.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

Figure 1 is a schematic circuit diagram of a liquid level control device according to the present invention.

Figure 2 is a circuit diagram showing a modification of the liquid level control device of Figure 1.

Referring to the drawings, 11 designates a fluid container to which fluid is supplied by a suitable pump driven by a motor 12. Motor 12 is controlled by a relay switch comprising a solenoid winding 13 having an armature 14 which cooperates with a pair of switch contacts 15, 15 to close the motor circuit when winding 13 is energized and thus actuate the pump to furnish fluid to tank 11. Positioned in tank 11 is a first electrode 16 extending to the low level limit position for the fluid, and a second electrode 17 extending to the high level limit position for the fluid. Tank 11 is grounded.

Positioned adjacent the tank 11 is a housing 18 containing a first solenoid switch device 19 and a second solenoid switch device 20. The winding of solenoid device 19 is connected at one terminal thereof to a power line conductor 21 and at the other terminal thereof to electrode 16. The other power line conductor 22 is grounded. Solenoid device 19 is provided with an armature 23 adapted to bridge a pair of contacts 24, 24'. Armature 23 is biased to a raised bridging position by a suitable spring, not shown, but is held in its depressed, open-circuiting position when the winding of solenoid device 19 is energized, as when the fluid in container 11 is above the level of the lower end of electrode 16.

The winding of solenoid 20 is connected at one terminal 25 thereof to electrode 17 and at the other terminal 26 thereof to line conductor

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22. Terminal 25 is connected, through a first current-limiting resistance 27 to the contact 24' of solenoid device 19. When solenoid device 19 becomes deenergized, the winding of solenoid 20 becomes energized through a circuit extending from line conductor 21, through contact 24, armature 23, contact 24', resistance 27, terminal 25, the solenoid winding, and terminal 26 to line conductor 22. Solenoid device 20 is provided with an armature carrying an inner bridging element 28 and an outer bridging element 29. Bridging element 28 is adapted to cooperate with an inner pair of contacts 30 and 31 and bridging element 29 is adapted to cooperate with an outer pair of contacts 32 and 33. In the deenergized condition of solenoid 20 the bridging elements are depressed and do not engage their contacts. When solenoid 20 is energized the bridging elements are raised into engagement with their respective contacts. Contacts 30 and 32 are connected to line conductor 21. Contact 31 is connected through a current-limiting resistance 34 to terminal 25. Contact 33 is connected to the ungrounded terminal of motor relay solenoid 13.

When the fluid in container 11 is at a level intermediate the high and low level limit positions as established by the respective electrodes 17 and 16, solenoid device 19 is energized and solenoid device 20 is deenergized. When the liquid level drops below electrode 16, solenoid device 19 becomes de-energized, causing armature 23 to rise to contact-bridging position and energizing the winding of solenoid 20, as above explained. The energization of solenoid 20 causes its armature to be raised so that inner bridging element 28 bridges inner contacts 30 and 31 and outer bridging element 29 bridges outer contacts 32 and 33. The bridging of inner contacts 30 and 31 establishes a holding circuit for the winding of solenoid 20 which extends from line conductor 21 through contact 30, bridging element 28, contact 31, resistance 34 and the solenoid winding to line conductor 22.

The bridging of outer contacts 32 and 33 energizes relay winding 13 through a circuit extending from line conductor 21 through contact 32, bridging element 29, contact 33 and relay winding 13 to line conductor 22. This energizes motor 12 and causes it to drive the pump to inject fluid into container 11. When the fluid level rises above the lower end of electrode 16, solenoid 19 is energized, thereby opening the original energizing circuit for solenoid 20, but solenoid 20 remains energized through its hold-

ing circuit. When the fluid level reaches electrode 17 the winding of solenoid 20 is shunted, causing its armature to drop and breaking its holding circuit. At the same time the circuit for relay winding 13 is opened and motor 12 becomes deenergized. The elements are then in their initial positions and remain thus until the fluid level again drops below electrode 16.

In the embodiment illustrated in Figure 2 the arrangement of the solenoids 19 and 20 is substantially the same as in the embodiment of Figure 1 but provision is made for energizing the motor relay winding 13' from the motor power supply line rather than from the power supply employed to energize the solenoids 19 and 20. Contact 32 is therefore connected to one of the motor power supply line wires 35 instead of to line wire 21 and the relay winding 13' is connected between contact 33 and another motor power supply line wire 36. The operation of the level control structure is the same as in the embodiment of Figure 1.

While certain specific embodiments of liquid level control devices have been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore it is intended that no limitations be placed on the invention other than as defined by the scope of the appended claims.

What is claimed is:

1. A device for maintaining liquid between predetermined limits in a container comprising a first electrode positioned in the container at the low liquid level limit therein, a second electrode positioned in said container at the high liquid level limit therein, a solenoid, a first pair of contacts for said solenoid, a second pair of contacts for said solenoid, a holding circuit for said solenoid including said first pair of contacts, said first and second pairs of contacts being open when said solenoid is deenergized and closed when the solenoid is energized, means responsive to the fall of liquid level in said container below said first electrode to energize said solenoid, and means responsive to the rise of liquid level to said second electrode for deenergizing said solenoid.

2. A device for maintaining liquid between predetermined limits in a container comprising a

first electrode positioned in the container at the low liquid level limit therein, a second electrode positioned in said container at the high liquid level limit therein, a first solenoid, a second solenoid, a first pair of contacts for said second solenoid, a second pair of contacts for said second solenoid, a holding circuit for said second solenoid including said first pair of contacts, said first and second pairs of contacts being open when said second solenoid is deenergized and being closed when said second solenoid is energized, means responsive to the fall of liquid level below said first electrode to operate said first solenoid, means responsive to the operation of said first solenoid to energize said second solenoid, and means responsive to the rise of liquid level to said second electrode for deenergizing said second solenoid.

3. A device for maintaining liquid between predetermined limits in a container comprising a first electrode positioned in the container at the low liquid level limit therein, a second electrode positioned in said container at the high liquid level limit therein, a first solenoid, an energizing circuit for said first solenoid including said first electrode, a second solenoid, a first pair of contacts for said second solenoid, a second pair of contacts for said second solenoid, a holding circuit for said second solenoid including said first pair of contacts, said first and second pairs of contacts being open when said second solenoid is deenergized and being closed when said second solenoid is energized, means responsive to the deenergization of said first solenoid to energize said second solenoid, and means responsive to the rise of liquid level to said second electrode for deenergizing said second solenoid.

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