Nov. 1, 1966 F. M. IANNELLI 3,283,095

FLOAT CONTROLLED MAGNETICALLY OPERATED SWITCH WITH A ROD FOR ROTATING A MAGNET INCLUDING A PAIR OF OPPOSED CONNECTED HELICES

Filed Sept. 18, 1964 2 Sheets-Sheet 1

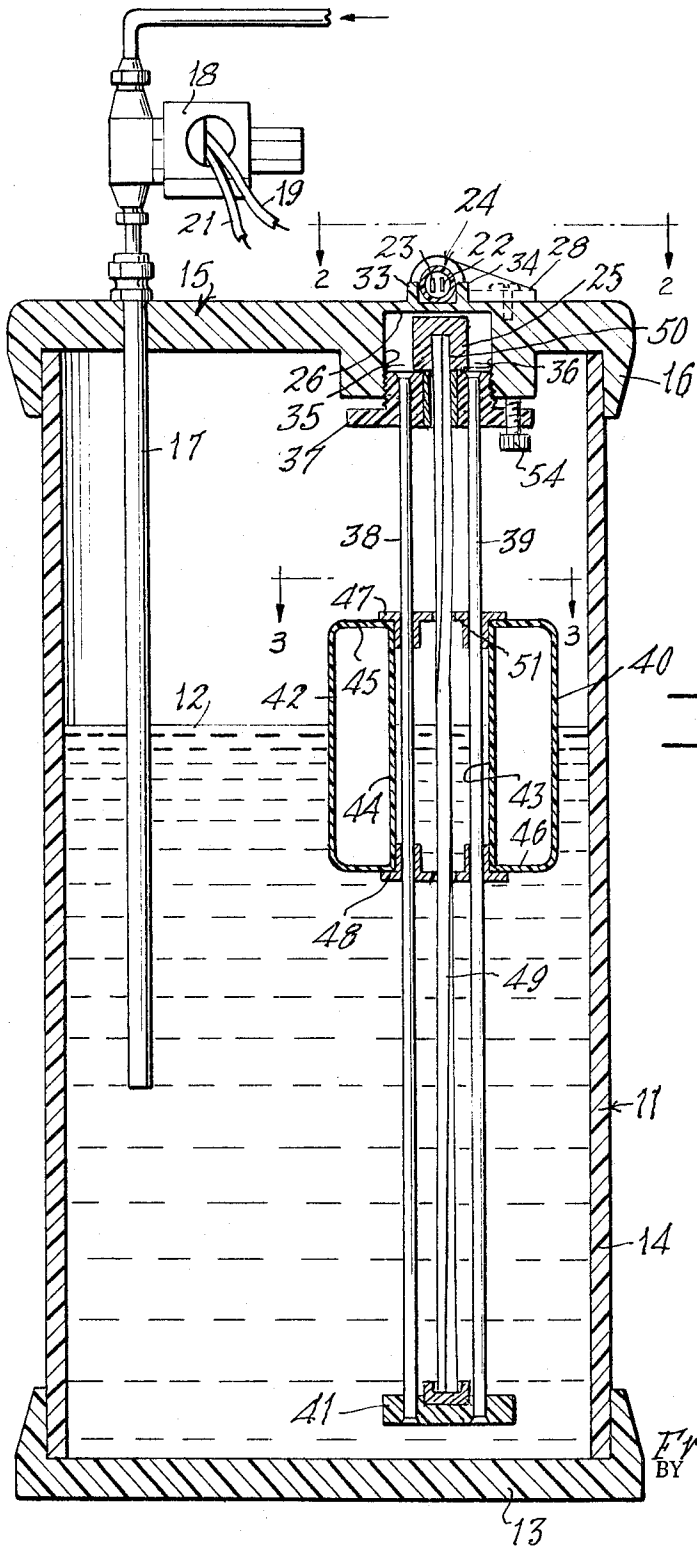


FIG. 1

INVENTOR.
Frank M. Iannelli,
BY
Harry B. Cook,
ATTORNEY

Nov. 1, 1966 F. M. IANNELLI 3,283,095

FLOAT CONTROLLED MAGNETICALLY OPERATED SWITCH WITH A ROD FOR ROTATING A MAGNET INCLUDING A PAIR OF OPPOSED CONNECTED HELICES

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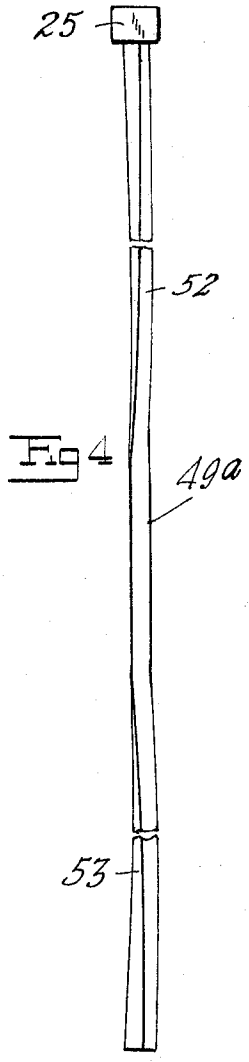


Fig 4

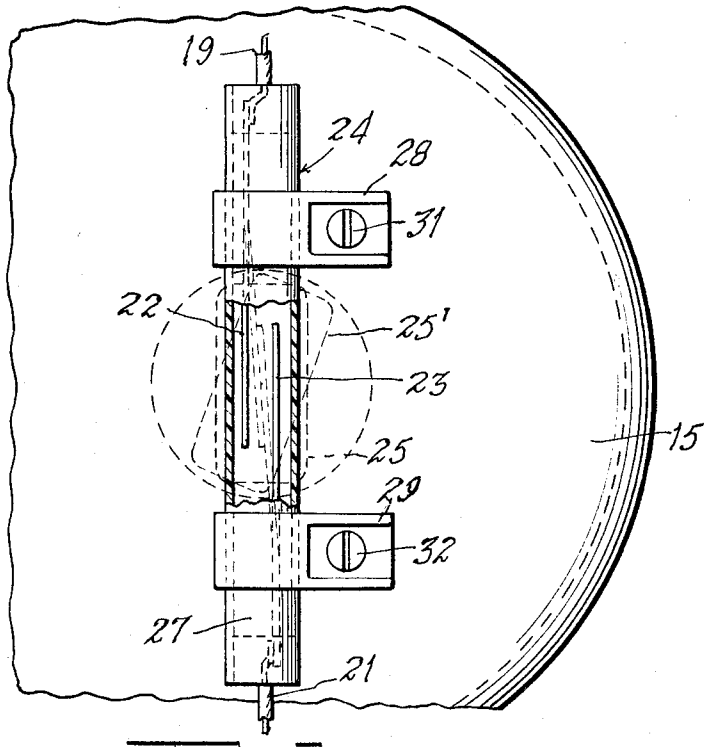


Fig 2

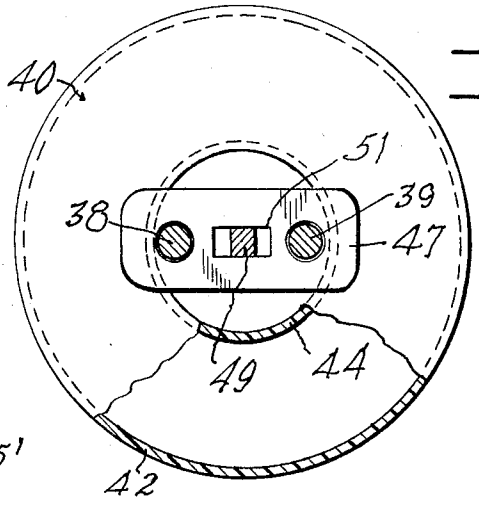


Fig 3

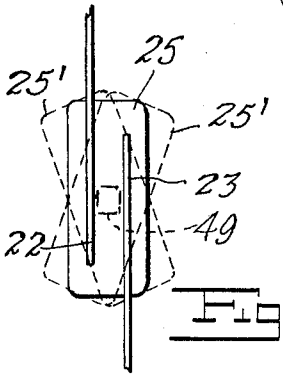


Fig 5

INVENTOR.
Frank M. Iannelli,
BY
Harry Bleich,
ATTORNEY

United States Patent Office

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3,283,095

FLOAT CONTROLLED MAGNETICALLY OPERATED SWITCH WITH A ROD FOR ROTATING A MAGNET INCLUDING A PAIR OF OPPOSED CONNECTED HELICES

Frank M. Iannelli, 5 Penwood Road, Livingston, N.J.

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3 Claims. (Cl. 200—84)

This invention relates to electrical switches and, more particularly, to one operable by a float in a liquid-holding tank.

The switch of the present application is particularly useful in pressure-containing vessels where a float is positioned in such a vessel and the switch is disposed on the outside thereof. A particular application of the invention is contemplated in connection with carbonating apparatus, such as described and claimed in Patent No. 2,782,061, issued to the present applicant under date of February 19, 1957.

An object of my invention is to produce a float-operable switch adapted for use in connection with a liquid-holding tank with a cover, wherein said switch preferably comprises a plastic tube into the opposite ends of which are sealed normally open leaf switch contacts, formed of iron or other magnetizable material, connected to a circuit to be controlled and supportable on the top of said tank cover, with means for operating said switch as the level of the liquid in the tank changes.

Another object of my invention is to produce a switch as above described, wherein the operating means comprises a permanent bar magnet disposed closely beneath said switch and turnable to open or closed position by a float in said tank, said float operating a steeply-pitched, helical rod turnable as the level of the liquid in the tank changes.

A further object of my invention is to provide a float-operable switch, as above generally described, wherein the switch-operating bar magnet has its axis horizontal and operable by said helical rod, non-circular but preferably square in section, said float carrying a plate which meshes with said helical rod so that, upon vertical movement of the float, the bar magnet non-rotatably connected to the top portion of said rod, is turned as the float moves up or down.

These and other objects and advantages will become apparent from the following detailed description when taken with the accompanying drawings. It will be understood that the drawings are for purposes of illustration and do not define the scope or limits of the invention, reference being had for the latter purpose to the appended claims.

In the drawings, wherein like reference characters denote like parts in the several views:

FIGURE 1 is a vertical sectional view, with parts in elevation, of a liquid-holding tank, on the cover of which is mounted a leaf switch operable by mechanism embodying my invention.

FIGURE 2 is an enlarged fragmentary plan of the tank, with parts of the switch broken away to show more clearly the interior construction, the view being in the direction of the arrows on the line 2—2 of FIGURE 1.

FIGURE 3 is an enlarged horizontal sectional view on the line 3—3 of FIGURE 1, in the direction of the arrows.

FIGURE 4 is an elevational view of the helical switch-operating rod, but showing a modification.

FIGURE 5 is an enlarged fragmentary plan of the permanent bar magnet, showing alternate positions in dotted lines and how it is related to the leaf contacts of the switch.

Referring to the drawings in detail, and first considering the embodiment of my invention illustrated in FIGURES 1, 2, 3 and 5, there is shown a tank **11** containing a liquid **12**, customarily water. The liquid **12** supplied to the tank may be fed thereto and removed therefrom by means not here shown, so that its depth in the tank changes. The tank has a bottom member **13** forming a closure, in this case fitting about the bottom part of a cylindrical wall **14**. The top closure or cover member **15** of the tank has a depending flange **16** overlying the top of the cylindrical portion **14**.

The cover **15** supports an open-ended pipe **17**, the lower end of which extends into the liquid **12** for a desired purpose, which may be for introducing or withdrawing liquid, or for introducing carbon dioxide thereinto for carbonating it, either when in a relatively pure condition or precarbonated and/or flavored. Flow of carbon dioxid,e, and/or other matter, into the liquid **12** or tank **11**, is here shown controlled by a valve **18**, which is merely representative or as an example of what may be done by my switch. Wires **19** and **21** from said valve **18** extend to the respective external ends of magnetizable leaf switch contacts **22** and **23**. A suitable source of electrical energy, not shown, is included in such a circuit, so that the vlave **18** is alternately opened and closed to let gas, or other material, pass to the liquid **12** upon closing and opening the electrical switch **24**, which includes the leaf contacts **22** and **23** each fixedly mounted at one end with its other end free and resiliently flexible toward and from the free end of the other contact.

The free ends of said leaf contacts **22** and **23** are normally separated, as viewed in FIGURES 2 and 5, but may be magnetically brought together or closed, or allowed to separate or reopen upon turning of a permanent bar magnet **25** about an axis that is parallel to the planes of said free ends of the leaf contacts. Said magnet is disposed closely beneath said leaf contacts but separated therefrom by the switch cover and the top wall **26** of the cover member **15**. The switch **24** desirably comprises a plastic, general hollow tube or cylindrical cover or housing **27** in the opposite ends of which are sealed the leaf contacts **22** and **23**, as most clearly shown in FIGURE 2. This tube **27** is shown held in place on top of the cover **15**, in the present embodiment, by a pair of clamps **28** and **29**, held in place on said cover **15** by means of screws **31** and **32**, or the like. The cover **15** is desirably provided with upstanding flanges **33** and **34** forming a socket in which fits the plastic tube **27**.

The cover **15** has a downwardly-opening pocket **35**, the lower interior portion of which is threaded as indicated at **36** and adjustably receives an upper rod mounting fitting **37**. Depending from this fitting are float-guiding means, here shown as a pair of rods **38** and **39** with their upper ends fixed thereto. In the present embodiment, the lower ends of said rods are also fixed, as by being fastened into a lower plate **41**, but as an alternative, said rods could be the upstanding arms of a U-shaped member. Both the cover **15** and the fitting **37**, like the tube **27**, are formed of non-magnetic material.

These rods **38** and **39** have slidaby mounted thereon a float **40**. In the present embodiment, said float **40** is shown with an outer generally hollow cylindrical portion **42** and has a central opening **43** defined by an inner hollow cylindrical portion **44**. The cylindrical portions **42** and **44** are closed at their tops and bottoms by annular portions **45** and **46**. The opening **43** is bridged, but not entirely closed, at its top by a plate **47**, and at its bottom by a plate **48**, said plates being apertured to receive and be non-rotatably guided on the rods **38** and **39**, so that the float **40** is adapted to ride up and down on said rods without turning.

In order to control the bar magnet **25**, there is an actuating rod **49** non-circular, or desirably square or rectangular in section as illustrated most clearly in FIGURE 3. Said section, however, is distorted as by twisting so that the rod **49** is shaped as a helix of a very high pitch. This helical rod **49** serves to turn the magnet **25** by having its upper end non-rotatably fitting a corresponding downwardly-opening socket **50** in said magnet, as shown most clearly in FIGURE 1. Its lower end is turnably carried on the plate **41** or other portion connecting the lower ends of the rods **38** and **39**, desirably received in an upwardly-opening socket in said portion, as shown in FIGURE 1. Its intermediate portion meshingly passes through a slot **51**, that is, with a turning action therebetween, as between toothed gears when engaged. The plate thus fits the rod **49** in such a way that, as the float **40** moves up and down, the rod **4** is turned because of its meshing helical form and effects a corresponding turning of the bar magnet **25** about a vertical axis.

In the embodiment just described, the non-circular actuating rod **49** may be uniformly helical from one end to the other so that as the float **40** rises the bar magnet **25** is turned from the dotted line position **25'** with its longitudinal axis at angles to the contacts shown in FIGURES 2 and 5 where contacts **22** and **23** have these ends touching for closing an electric circuit, to lie as shown in the full line position designated **25** (FIGURE 5) with its longitudinal axis parallel to the contacts where the lines of force from said magnet are removed from **22** and **23** so that they will be free and open effecting the opening of an energized circuit controlled thereby and a desired operation, such as the operation of the valve **18**.

In the embodiment in FIGURE 4, however, the rod, here designated **49*a*** may have its central portion formed and positioned as viewed in FIGURE 3 and its end portions **52** and **53** helically formed or twisted therefrom in opposite directions. When so formed a movement of float **40** from top of **52** to bottom of **52** will effect an engagement of the leaf contacts **22** and **23** and closing of said switch. A further movement of float **40** traveling length of **53** toward bottom will reversely rotate the magnet to effect separation of leaf contacts **22** and **23** and opening of the switch. This contrasts with the first embodiment in which the leaf contacts **22** and **23** may be engaged to close the switch when the float **40** is at the bottom of the tank, while not separated to open the switch until the float reaches a position at or near the top of said tank. By making the twisted portions at selected distances apart or at selected locations, my switch may effect a control of the liquid so as to hold it at a desired level, or effect a desired operation at such a liquid level.

The permanent magnet **25** may be adjusted toward and from the switch contacts **22** and **23**, when desired, by simply rotating the mounted fitting **37** and locking it in adjusted position by a thumb screw **54** threaded in the fitting and abutting the cover **15**.

I claim:

1. A float-controlled magnetically operated switch for use in a liquid holding tank that has a non-magnetic top closure, a pair of contacts at least one of which is a leaf contact and magnetic with one end fixedly mounted and with its other end free and resiliently flexible toward and from the other contact, means mounting said contacts on the upper side of said top closure, a permanent bar magnet mounted at the opposite side of said top closure to rotate about an axis, the free end of said magnetic contact being responsive to the magnetic field of the magnet, providing for movement of said magnetic contact into and out of engagement with the other contact upon turning

of the bar magnet in opposite directions respectively, and means for rotating said magnet about said axis including an helical rod rotatable on the second-mentioned side of top closure about said vertical axis and connected to said bar magnet to turn it about said axis upon rotation of the rod, and a float adapted to be mounted in said tank for movement in accordance with the changes in the liquid level in the tank and meshing with said helical rod to rotate the rod upon vertical movement of the float, said rod having portions helically twisted in opposite directions from an intermediate point in the length thereof whereby when the float is moved along said rod the magnetic contact will be successively moved into and out of engagement with the other contact.

2. A float-controlled magnetically operated switch for use in a liquid holding tank that has a non-magnetic top closure, a pair of contacts at least one of which is a leaf contact and magnetic with one end fixedly mounted and with its other end free and resiliently flexible toward and from the other contact, means mounting said contacts on the upper side of said top closure, a permanent bar magnet mounted at the opposite side of said top closure to rotate about an axis, the free end of said magnetic contact being responsive to the magnetic field of the magnet, providing for movement of said magnetic contact into and out of engagement with the other contact upon turning of the bar magnet in opposite directions respectively, and means for rotating said magnet about said axis including an helical rod rotatable on the second-mentioned side of top closure about said vertical axis and connected to said bar magnet to turn it about said axis upon rotation of the rod, and a float adapted to be mounted in said tank for movement in accordance with the changes in the liquid level in the tank and meshing with said helical rod to rotate the rod upon vertical movement of the float and wherein there is a mounting fitting adjustably mounted on the second-mentioned side of said top closure for movement toward and from said contacts, and said bar magnet and said means for rotating the bar magnet are mounted on said mounting fitting, providing for adjustment of the bar magnet toward and from said contacts.

3. A magnetically operated switch as defined in claim **1** wherein both of said contacts are leaf contacts each fixedly mounted at one end with its other end free and resiliently flexible toward and from the free end of the other contact, said rod is connected to the bar magnet intermediate the ends of the magnet and is rotatable about an axis that is parallel to the planes of said free ends of the leaf contacts, the magnet being normally parallel to said contacts and the free ends of the contacts being normally in spaced relation to each other whereby upon rotation of the magnet from its normal position, the contacts are moved into engagement with each other.

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BERNARD A. GILHEANY, *Primary Examiner.*

H. A. LEWITTER, *Assistant Examiner.*