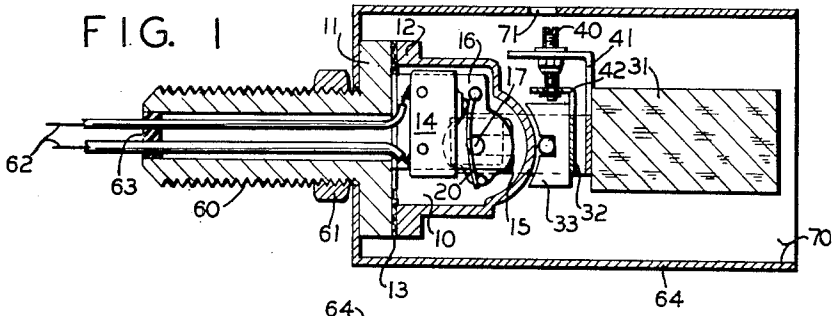
June 21, 1955 T. OPUSZENSKI 2,711,454

FLOAT ACTUATED ELECTRICAL CIRCUIT SWITCH

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FIG. 1



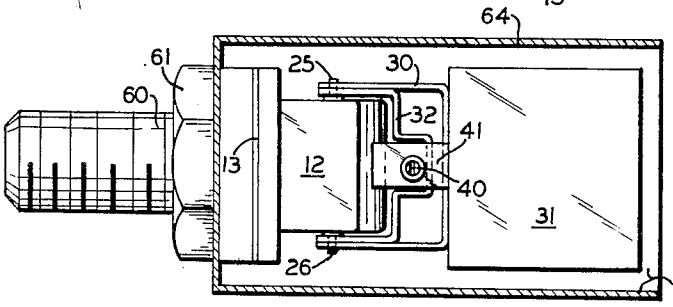


FIG. 2

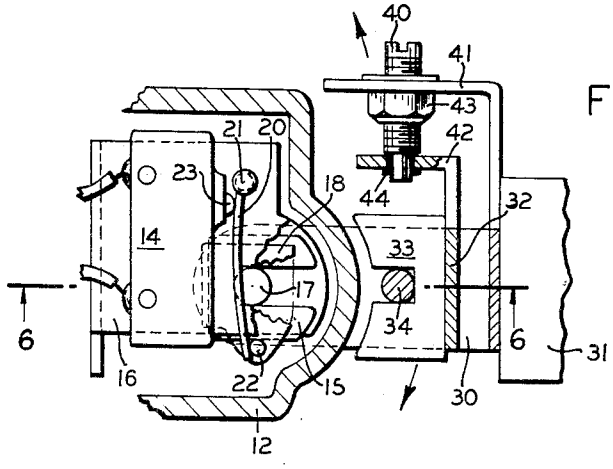


FIG. 3

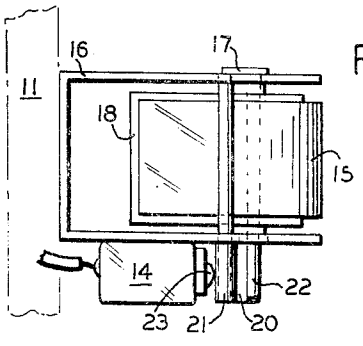


FIG. 4

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FLOAT ACTUATED ELECTRICAL CIRCUIT SWITCH

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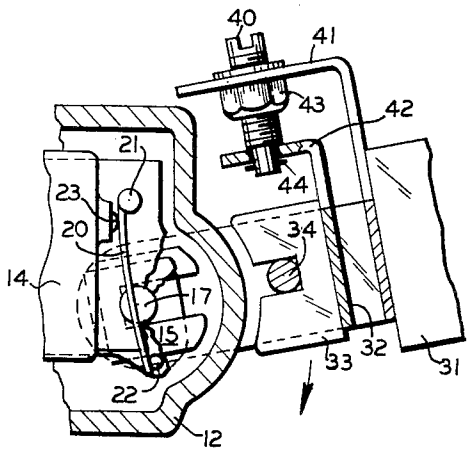


FIG. 5

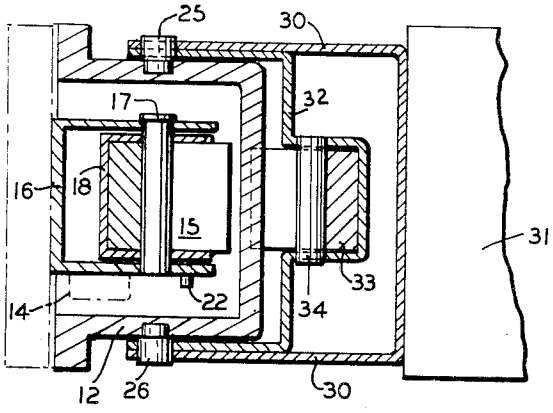


FIG. 6

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FLOAT ACTUATED ELECTRICAL CIRCUIT SWITCH

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Application November 3, 1953, Serial No. 389,949

2 Claims. (Cl. 200—84)

This invention relates to float actuated electrical circuit switches and more particularly to float actuated electrical switches which are partially or wholly immersed into a liquid. While this invention is subject to a wide range of applications, it is especially suited for use with inflammable liquids where the electrical circuit contacts must be shielded from explosive vapors.

Float actuated electrical switches are well known in connection with liquid filling operations. When controlling the level of inflammable liquids, magnetic means are frequently employed to transmit the motion of the float to the actuating means of an electrical switch which is housed in a fluid tight chamber. The electrical switch actuated is the controlling means for the filling pump, for an alarm or signaling device, or for a similar control device. Switches of this type and presently used are comparatively large in physical size and burdened with an undue amount of mechanical linkage elements. It is difficult therefore, to use such switches in confined spaces or in locations where space is at a premium, as for instance in airborne equipment. Still further, large size structures are adversely affected by vibration, becoming unreliable and inaccurate.

One of the objects of this invention is to provide an improved float actuated electrical circuit switch which avoids one or more of the disadvantages of prior art arrangements.

Another object is the provision of a switch of the character described which is of small physical dimensions and of compact construction thus being suited for use in confined spaces.

Another object of this invention is the provision of a float actuated electrical switch which because of its few parts is easy to manufacture and of economical construction.

A still further object of this invention is to provide a switch which may be used for expendable purposes.

Another and further important object of the invention is the provision of a float actuated electrical circuit switch which is equipped with adjustable calibrating means for precise liquid level control.

One of the features of this invention includes a float actuated electrical circuit switch which comprises an enclosure adapted to be immersed into a liquid. A first magnetic means and an electrical circuit switch are disposed inside of the enclosure. The first magnetic means is supported for pivotal motion relative to said enclosure and said switch. Lever means between the first magnetic means and the actuating means of the switch cause switch actuation as a result of pivotal motion of said first magnetic means. A second magnetic means and a float are disposed outside of said enclosure and are mounted for pivotal motion in unison about the enclosure. The first and second magnetic means form a magnetic circuit causing the first magnetic means disposed inside of the enclosure to move in response to the motion imparted to the second magnetic means which is disposed outside of the enclosure.

For a better understanding of the present invention together with other and further objects thereof, reference is made to the following description taken in connection with the accompanying drawings in which:

Figure 1 is a side elevation, partly in section;

Figure 2 is a plan view with housing sectioned;

Figure 3 is an enlarged side elevation of certain working parts;

Figure 4 is a top view showing the bracket in which one magnet pivots;

Figure 5 is the same view as Figure 3 with certain parts in shifted position; and

Figure 6 is a sectional view at 6—6 of Figure 3.

Referring now to the figures, numeral **10** identifies a fluid tight chamber which is formed by a two-piece enclosure, namely back plate **11** and a bell shaped housing **12**. Housing **12** and back plate **11** are joined in fluid tight relation by means of a gasket **13** and screw means (not shown). It is understood that other sealing means including brazing, welding, soldering, plastic resins etc. may be used to accomplish a fluid tight enclosure. Within this fluid tight enclosure there is disposed a stationary electrical circuit switch **14** supported from the back plate **11** by a bracket **16**, and also a first permanent magnet **15** which is mounted for pivotal motion relative to housing **12** by virtue of pivotal stud **17** supported in bracket **16**. Magnet **15** is retained on stud **17** by means of a magnet bracket **18** which pivots in unison with the magnet about the central axis of stud **17**. Switch **14** is a push button actuated snap action switch, frequently termed "microswitch." As magnet **15** is caused to pivot about the central axis of stud **17** (source of motion will be described later) lever means, which include arm **20** supported between stationary pin **21** and pin **22** attached to movable magnet bracket **18**, cause switch actuation by engaging the actuating push button **23** of the electrical circuit switch **14**.

Two pivoting studs **25** and **26** are fastened to the outside of the housing **12** but do not penetrate to the inside of the enclosure so as not to puncture the fluid tight chamber. These studs are adapted to pivotally support a float bracket **30** connected to a float **31**, and also a magnet bracket **32** which holds a second permanent magnet **33** and magnet retaining stud **34**. The float **31** and magnet **33** are mounted for pivotal motion in unison by virtue of screw stud **40** which retains a bracket extension **41** attached to float bracket **30** in fixed distance with respect to an extension **42** attached to magnet bracket **32**. A flange riveted locknut **43** and pin **44** are used to secure the position of stud **40** with respect to the bracket extensions **41** and **42** respectively. Locknut **43** preferably is of the pressure engaging type having a yieldable insert, commonly known as "elastic stop nut."

Magnets **15** and **33** are disposed opposite each other and arranged with complementary pole notation, i. e. a magnetic circuit with attracting forces between both magnets. In order not to diminish the magnetic force between the magnets, the curved portion of the housings **12** disposed between the magnets and about which the magnets pivot, is made preferably of substantially non-magnetic material.

In the preferred embodiment, studs **25** and **26** are positioned upon the exterior of housing **12** in such a manner that they are in alignment with stud **17**, resulting that both magnets pivot about a common axis to maintain constant gap distance.

The float actuated switch structure described above is mounted by means of threaded fitting **60** and nut **61** inside of a tank which is adapted to retain the liquid whose level is to be controlled. The electrical conductors **62** leading from the switch **14** are brought to the exterior of chamber **10** in fluid tight relation by means of

sealing gasket 63. A housing 64 supported on fitting 60 serves to provide not only mechanical protection for the exposed active parts (float and magnet), but is adapted also to limit the pivotal motion of float 31. This feature is particularly advantageous when excessive mechanical vibration is encountered or when the liquid level exceeds the control limits of the switch.

In operation, the liquid of the tank communicates with the float and with the outside of the fluid tight enclosure by means of the large aperture 70 of the housing 64. As the liquid level rises, the float pivots in counterclockwise direction carrying along magnet 33. This magnet transmits its motion to the inside of the fluid tight chamber by virtue of its interlinking magnetic circuit with magnet 15. Magnet 15 thus is caused to follow the motion of the outer magnet (Figure 5) and the lever arrangement between magnet 15 and switch 14 causes switch actuation when a predetermined pivotal position is reached. This switch actuation may be used to control the electrical circuit of the pump motor, to cause the operation of an alarm circuit, or the operation of some other suitable control means.

In order to accurately adjust the switch actuation relative to the liquid level desired, adjusting screw 40 is rendered accessible from the outside of housing 64 via aperture 71. An adjustment of this screw stud changes the fixed position of float 31 relative to the associated magnet 33, thus obtaining a convenient method for precise liquid level control. It will be apparent also that this adjusting means serves to provide convenient calibration means for factory adjusted and readily interchangeable float actuated electrical circuit switches.

Although the foregoing description and illustrations show the use of two permanent magnets, it will be apparent that a single magnet and an opposing member made of magnetizeable material will perform in a satisfactory manner. Still further, the magnet shown and described may be replaced by an electromagnet without departing from the principle of the invention.

The fluid tight chamber which contains the electrical switch may be immersed into inflammable liquids without danger of explosion since the opening and closing of electrical contacts is separated from the liquid itself.

It will be observed that the structure disclosed is devoid of long levers and complicated mechanical motions and moments. The adjusting means between the float and associated magnet permit precise control of switch actuation over a wide range of liquid levels. The construction is compact and characterized by a minimum number of moving parts, thus rendering the switch mechanism suited particularly for airborne equipment. The small size of the individual components, the rugged construction and the short pivotal motions cause the float actuated switch to be inherently insensitive to mechanical disturbances, such as the effects of vibration, shock, acceleration, rough handling, etc. The economical manufacture of the disclosed construction, caused as a result of the small quantity of individual parts, ease of assembly, and simplicity of adjustment and calibration after final assembly, permits this float actuated switch to be used for expendable fuel tanks and similar devices which are becoming evermore significant.

While there have been described and illustrated specific embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the spirit and field of the invention which should be limited only by the scope of the appended claims.

What is claimed is:

1. A float actuated electrical circuit switch comprising a fluid tight enclosure adapted to be immersed into a liquid, a first permanent magnet and an electrical circuit switch disposed inside of said enclosure, said first magnet supported for limited pivotal motion relative to said enclosure and said switch, lever means between said first magnet and the actuating means of said switch to cause switch actuation as a result of pivotal motion of said first magnet, a second permanent magnet and a float disposed outside of said enclosure and mounted for pivotal motion in unison about a substantially non-magnetic portion of said enclosure, said first and second magent being spaced apart with complementary opposing pole faces to form a magnetic field with attracting forces between said magnets to cause said first magnet to move in the same direction as said second magnet when imparting motion to said second magnet, the pivotal axes of both magnets being substantially coincident to maintain uniform gap distance between said pivotally moving magnets, screw adjusting means disposed between said second magnet and said float for adjusting the relative position therebetween, a housing supported by said enclosure and shaped to extend over a portion of said float, said housing equipped with a first aperture to permit communication between the liquid and said float and with a second aperture to permit communication between the outside of said housing and said screw adjusting means and said housing being adapted to limit the pivotal motion of said float.

2. A float actuated electrical circuit switch comprising a fluid tight enclosure adapted to be immersed in a liquid, a first permanent magnet and a snap acting electrical circuit switch disposed inside of said enclosure, said first magnet supported for limited pivotal motion relative to said enclosure and said switch, lever means between said first magnet and the actuating means of said switch to cause switch actuation as a result of motion of said first magnet, said lever means including an arm supported between a stationary pin and a magnet motion responsive movable pin, a second permanent magnet and a float disposed outside of said enclosure and mounted for limited pivotal motion in unison about a substantially non-magnetic portion of said enclosure, said first and second magnet interconnected by magnetic force which causes said first magnet to move in response to motion imparted to said second magnet, the pivotal axes of both magnets being substantially coincident to maintain uniform gap distance between said magnets, screw adjusting means disposed between said second magnet and said float for adjusting the relative position therebetween, a housing supported by said enclosure and shaped to extend over a portion of said float, said housing equipped with an aperture to permit communication between the liquid and said float and an aperture to permit communication between the outside of said housing and said screw adjusting means, and said housing being adapted to limit the pivotal motion of said float.

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