United States Patent [19]

Innes et al.

[11] **3,751,616**

[45] **Aug. 7, 1973**

[54] **FLOAT SWITCHES**

[75] Inventors: **Robert Innes**, Beaconsfield; **Norman West**, High Wycombe, both of England

[73] Assignee: **Ronald Trist Controls Limited**, Slough, England

[22] Filed: **June 28, 1972**

[21] Appl. No.: **267,221**

[30] **Foreign Application Priority Data**

July 21, 1971 Great Britain 34,250/71

[52] **U.S. Cl.** ..... **200/84 C**

[51] **Int. Cl.** **H01h 35/18**

[58] **Field of Search** ..... 200/84 C, 81.9 M

[56] **References Cited**

UNITED STATES PATENTS

2,887,546	5/1959	Hatfield	200/81.9 M
2,927,176	3/1960	Auld, Jr. et al.	200/84 C
3,359,385	12/1967	Bentz et al.	200/81.9 M
3,322,917	5/1967	Furlow	200/84 C
2,857,492	10/1958	Kathe	200/84 C
3,421,124	1/1969	Kidd	200/81.9 M

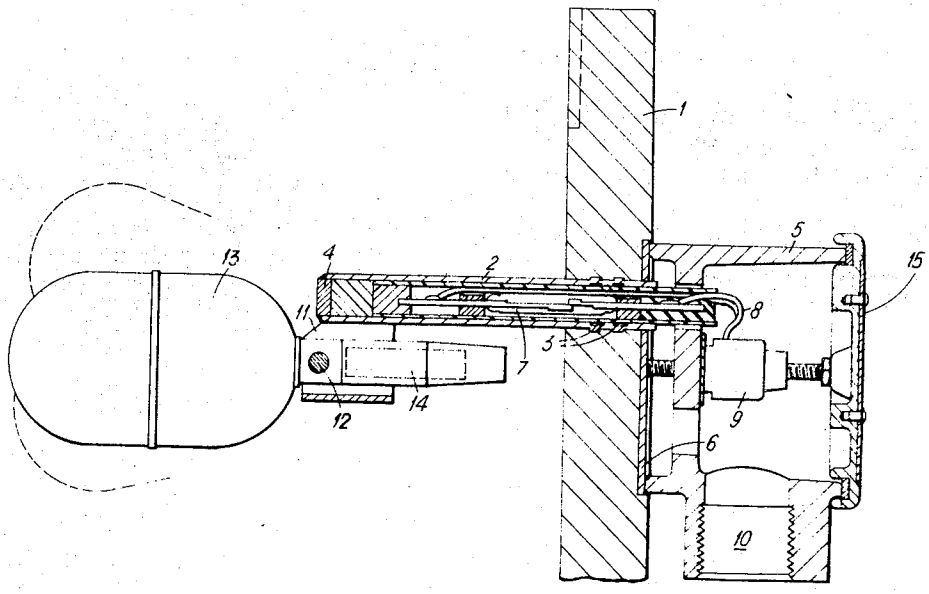
Primary Examiner—David Smith, Jr.

Attorney—John F. Brisebois et al.

[57] **ABSTRACT**

An electrical switch assembly, for measuring liquid levels or flow, has a mounting plate which is arranged to be fitted to a container wall to seal an aperture through the wall; a tube which is made of a non-magnetic material, which extends through and is sealed in a bore in the plate, and which has its end on the wet side of the plate sealed; a sensing element which is arranged to be moved by the liquid in the container and a magnet which, with the sensing element, is pivotally mounted on the wet side of the mounting plate; a magnetically responsive switch contact unit within the tube and responsive to movement of the magnet upon movement of the sensing element; and a terminal housing mounted on the dry side of the mounting plate and incorporating terminals connected to the switch contact unit.

7 Claims, 2 Drawing Figures



PATENTED AUG 7 1973

3,751,616

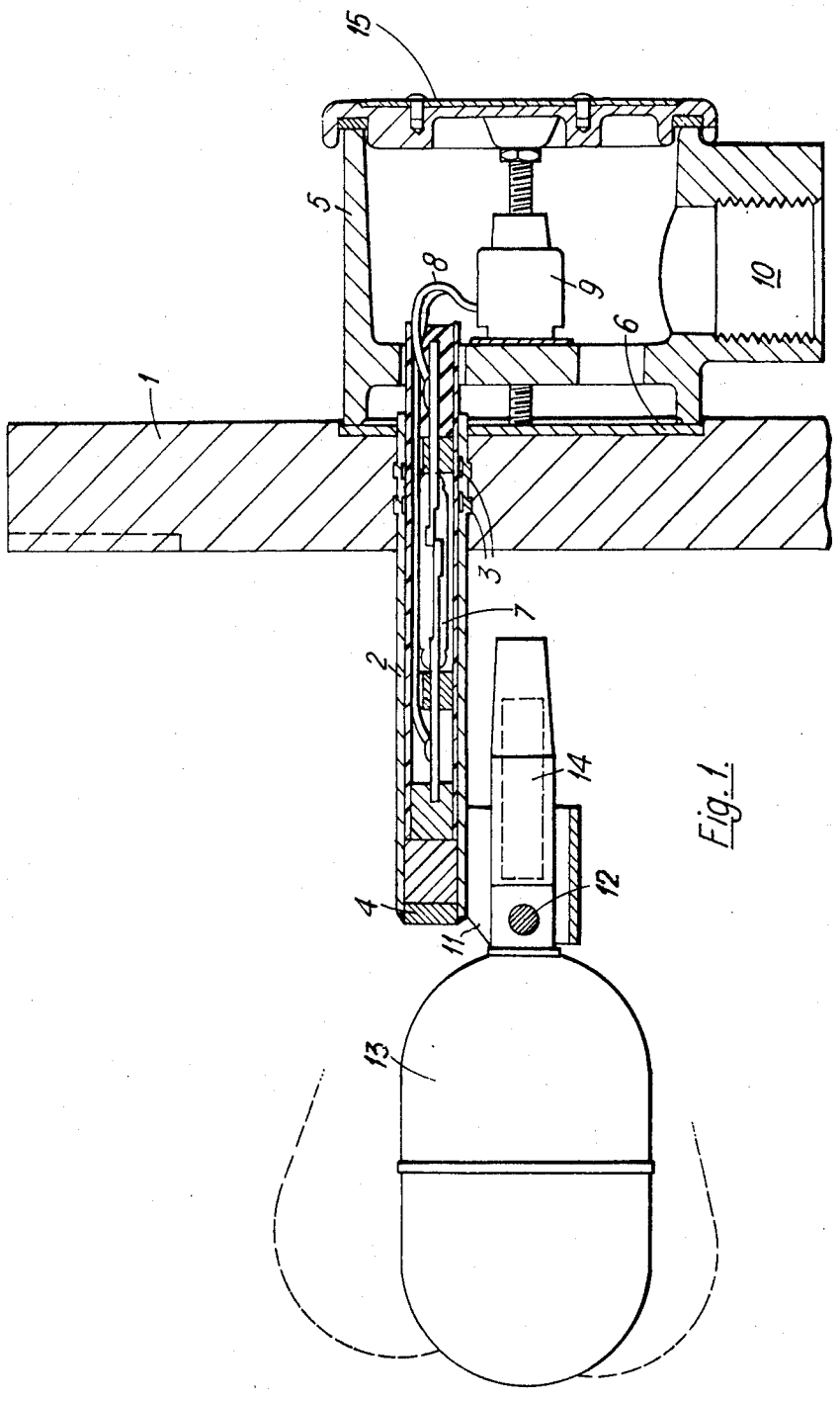


Fig. 1

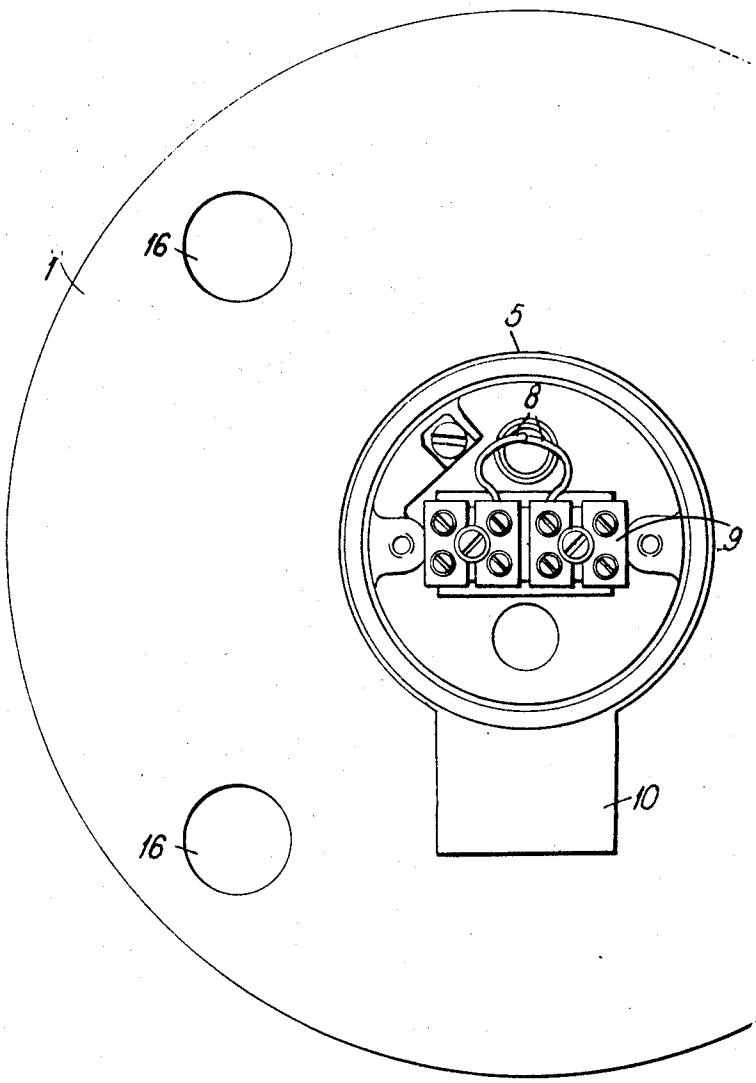


Fig. 2.

FLOAT SWITCHES

The invention is concerned with electrical switch assemblies for measuring liquid levels or flow, and which is mounted in a wall of a boiler or other liquid container. The assembly has a sensing element which is arranged to be moved by the liquid and a magnet which is connected to and moves with the sensing element, the magnet operating magnetically responsive switch contacts through a non magnetic wall which separates the switch contacts from the interior of the container. The sensing element may be, for example, a float which is moved upon change in liquid level or a paddle which is moved by flow of the liquid.

In a conventional construction of such assembly, the assembly is mounted at an aperture in the container wall by means of a mounting plate having a peripheral edge which overlaps the container wall around the aperture and is bolted to it with an interposed gasket. The sensing element and magnet are then pivotally mounted on the wet side of the mounting plate and the switch contacts are mounted on the dry side of the plate the plate being of a non-magnetic material so that the magnet can influence the switch contacts through the plate. Since the mounting plate is responsible for maintaining a liquid seal with the container wall, it must be of comparatively large and robust construction. Since it is made of a non-magnetic material, such as stainless steel, which is expensive, each contributes appreciably to the overall price of the assembly. Difficulties may also arise with regard to the sensitivity of the response of the switch contacts through the mounting plate.

In accordance with the present invention an electrical switch assembly, for measuring liquid levels or flow, comprises a mounting plate which is arranged to be fixed to a container wall to seal an aperture through the container wall; a tube which is made of a non-magnetic material, which extends through and is sealed in a bore in the plate, and which has its end on the wet side of the plate sealed; a sensing element which is arranged to be moved by the liquid in the container and a magnet which, with the sensing element, is pivotally mounted on the wet side of the mounting plate; a magnetically responsive switch contact unit within the tube and responsive to movement of the magnet upon movement of the sensing element; and a terminal housing mounted on the dry side of the mounting plate and incorporating terminals connected to the reed switch contact unit.

With this construction the mounting plate may be made of a cheap material such as mild steel, although it may be made of a non-corrosive material such as stainless steel if the liquid is such that it is desirable to present a non-corrosive material completely on the wet side of the assembly. However, the assembly may be extremely sensitive because the tube may be comparatively thin walled, compared with the thickness of the mounting plate, and consequently the magnet may move in comparatively close proximity to the switch contact unit. This construction also has a good tolerance to vibration.

The switch unit of the assembly may be a reed switch, or, alternatively, a micro-switch the arm of which cooperates with the magnet. With either of these types of switches the assembly is very suitable for use with "fail-safe" switching systems.

Preferably, the tube which may be made of stainless steel extends closely through a bore in the mounting plate and is expanded at say two annular rings to very tight sealing engagement with the wall of the bore. A glandless seal connection between the tube and the mounting plate is thus provided by normal metal-working techniques. The sensing element and magnet may be mounted independently on the mounting plate, but are preferably mounted on the sealed end of the tube. The necessary special relationship between the moving magnet and the switch contact unit is thus assured.

One example of a switch assembly constructed in accordance with the present invention will now be described with reference to the accompanying drawings, in which:

FIG. 1 is a partially sectioned side elevation of the assembly; and

FIG. 2 is a view on arrow II in FIG. 1, the terminal cover having been removed.

This example has a mounting plate 1 which is arranged to be mounted overlapping the edge of an aperture in a vertical side wall of a liquid container. A stainless steel tube 2 extends through a bore in the plate and is sealed in it by means of two annular expansion rings 3. The end of the tube on the wet side of the plate is sealed by means of a welded plug 4. The tube extends by over half its length from the wet side of the mounting plate and extends just from the dry side of the mounting plate into a terminal housing 5 which is screwed and sealed by a gasket 6 to the dry side of the mounting plate. The tube contains substantially centrally a sealed reed switch contact unit 7. One of the reeds of the unit extends from the unit towards the wet side end of the tube and lead wires 8 extend from the unit through the dry side end of the tube into the terminal housing 5 where they are connected in a terminal block 9 having connections for outside wires. These outside wires which are not shown would leave the terminal housing through the opening 10, which in this case is shown threaded for the attachment of a conduit for containing the wires. The wet side end of the tube supports the bracket 11 which carries, on a horizontal pivot 12, a float 13 and a stainless steel encapsulated bar magnet 14.

FIG. 2 shows in detail the arrangement within the terminal housing 5, the cover 15 having been removed. The holes 16, through which mounting bolts would extend to fix the mounting plate to the liquid container, can also be seen.

In operation, the float moves upwards and downwards with the liquid level, the operative end of the magnet moving downwards and upwards respectively beneath the end of the tube and below the end of the projecting reed. Thus as the float rises the reed switch is relieved of the influence of the magnet and it adopts its equilibrium position, and as the float falls the magnet rises and the reed switch contact unit responds.

For use in measuring flow, this switch assembly is very simply modified. The mounting plate might be mounted horizontally in a conduit wall, and the float 13 would be replaced by a paddle. This arrangement would produce a very sensitive flow switch.

We claim:

1. An electrical switch assembly, for measuring liquid levels or flow, comprising a mounting plate which is arranged to be fixed to a container wall to seal an aper-

ture through said container wall; a tube which is made of a non-magnetic material, which extends through and is sealed in a bore in said plate, which is expanded at two annular rings into tight sealing engagement with the wall of said bore, and which has its end on the wet side of said plate sealed; a sensing element which is arranged to be moved by the liquid in said container and a magnet which, with said sensing element, is pivotally mounted on said wet side of said mounting plate; a magnetically responsive switch contact unit within said tube and responsive to movement of said magnet upon movement of said sensing element; and a terminal housing mounted on the dry side of said mounting plate and incorporating terminals connected to said switch contact unit.

2. An electrical switch assembly according to claim 1, in which said tube is made of stainless stee'.

3. An electrical switch assembly according to claim 1, in which said sensing element and magnet are mounted on the sealed end of said tube.

4. An electrical switch assembly according to claim 1, in which said sensing element is a float, and the assembly is adapted for use in the measurement of liquid levels.

5. An electrical switch assembly according to claim 1, in which said sensing element is a paddle, and the assembly is adapted for usein the measurement of liquid flows.

6. An electrical switch assembly according to claim 1, in which said switch is a reed switch.

7. An electrical switch assembly according to claim 1, in Which said switch is a micro-switch, an arm of the micro-switch co-operating with said magnet.

* * * * *