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J. M. NYE

2,391,068

FLUID PRESSURE ELECTRICAL SWITCH

Filed July 29, 1943

2 Sheets-Sheet 1

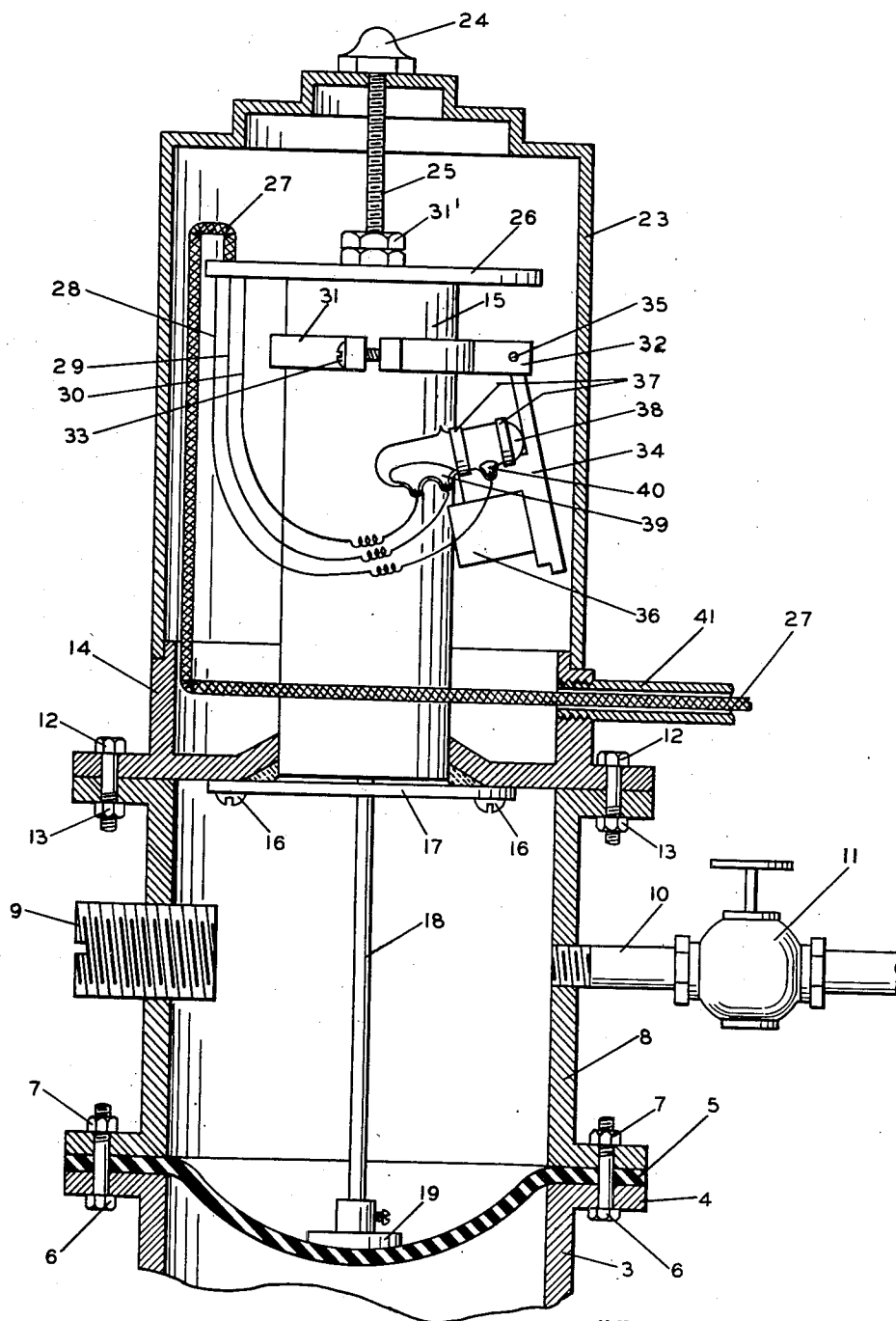


FIG. -1

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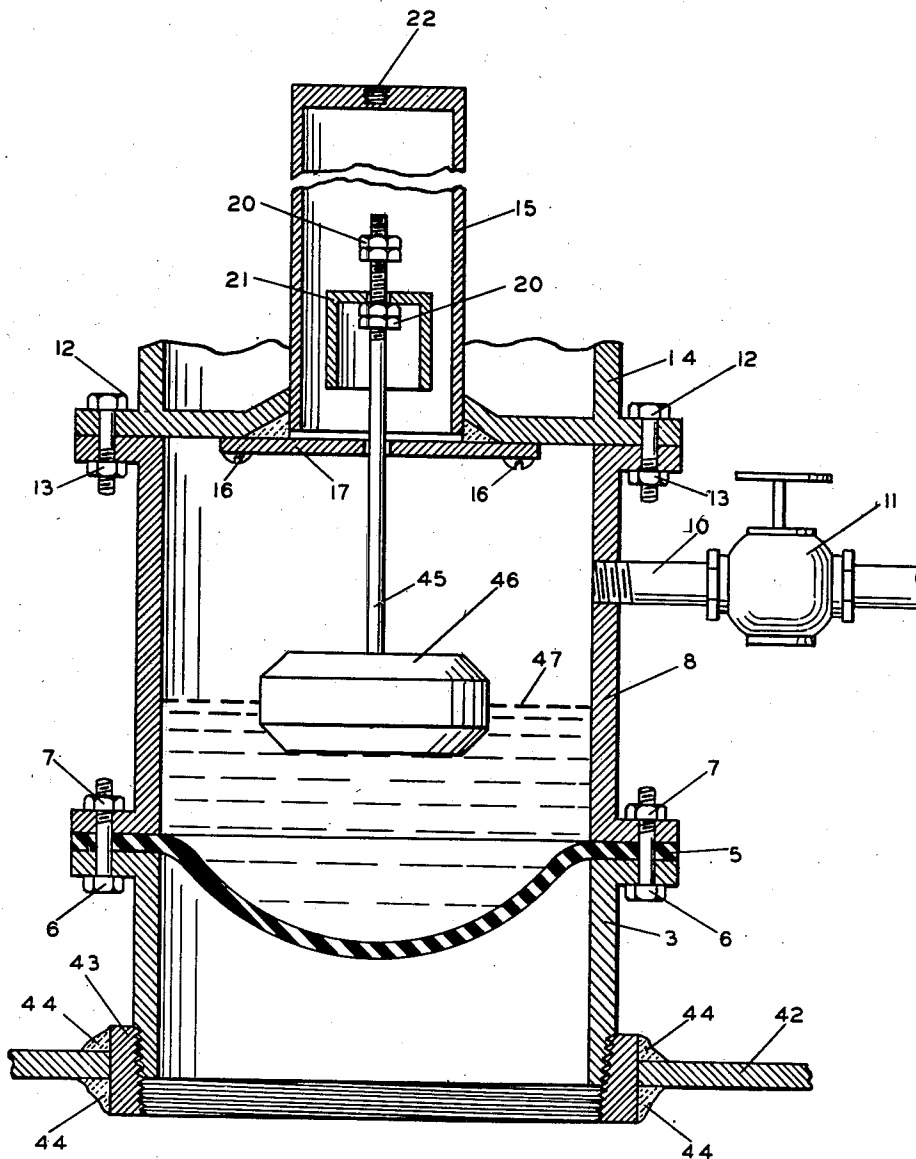


FIG. - 2

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FLUID PRESSURE ELECTRICAL SWITCH

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8 Claims. (Cl. 200—83)

This invention relates to pressure operated switches and it has particular relation to electrical switches operated by pressure of fluids containing solidifiable, congealable or precipitable solid matter.

One object of this invention is to operate a switch by means of pressure in a fluid which contains paraffin or other congealing or precipitating solid materials which would plug the tube of a Bourdon gage.

Another object of my invention is to adopt such a pressure transmitting means as set forth in the above paragraph to a "magnetrol" electrical switch.

Another object of my invention is to provide a pair of barriers to the escape of fluid so that if the fluid penetrates the diaphragm it will not escape from the device and will not reach the electrical switch where it would cause fire or other damage.

Another object of my invention is to provide a device which will operate under high pressure and under adverse conditions.

Other objects of my invention are to provide a self contained pressure switch unit which will not leak, get out of order, or be influenced by outside factors and in which the parts are simple in operation and construction and easy to replace or repair.

Further objects will be obvious to those skilled in the art from reading the specification and the claims and from looking at the figures of the drawings.

Much trouble has been caused in the prior art of pressure switches when used on petroleum pipes because the tube leading to the pressure switch became plugged with paraffin or congealing oil. Oftentimes the diaphragm would fall, releasing the oil or gas where it would reach the electrical switch and catch fire. Such fires have resulted in destruction of valuable property. The switches of the prior art contain material parts which were stressed repeatedly and which crystallized and broke under conditions of fatigue.

Applicant has avoided the difficulties of the prior art by providing a pressure transmitting device for the electrical switch which has a large opening which can not be clogged with paraffin and in which failure of the diaphragm will not result in a fire. As there is no material to fatigue or crystallize or any springs to break after repeated flexing, the difficulties of the prior art are avoided. The inaccurate operation of the Bourdon type device in which the tube becomes sprung out of shape after long use is avoided.

In the drawings:

Figure 1 is an elevational view mainly in cross section of an illustrative embodiment of my invention showing one type of electrical switch employed.

Figure 2 is an elevational view of a modification of my invention shown mainly in cross section and with parts broken away.

In Figure 1, a large diameter pipe 3 may be connected in any desired manner to a pipe, tank, or other apparatus (not shown) containing oil or other fluid, such as a gas containing suspended precipitable material, tending to congeal or precipitate solids. Pipe 3 ends in a flange 4 on which a flexible diaphragm 5 is supported. This diaphragm may be made of rubber, or of "neoprene" or any flexible substance preferably resistant to attack by the fluid used. Flexibility is essential and together with resistance to the fluids it is exposed to will result in long life. Diaphragm 5 is preferably of a diameter substantially greater than would be plugged with precipitates between normally spaced overhauling tours, and for some paraffins is several inches in diameter.

Secured to flange 4 to bolts 6 and nuts 7 and holding down diaphragm 5 is pressure chamber 8. A screw plug 9 is provided for varying the volume of the pressure chamber as it is screwed in or out of the chamber. A conduit 10 and valve 11 are provided to supply or remove fluid from chamber 8.

Closing the top of chamber 8 and secured thereto by bolts 12 and nuts 13 is an electrical switch housing base 14. Welded to the central portion of the base is an inverted cylindrical cup member 15 which is best seen in Figure 2. Secured to the lower side of base 14 by screws 16 is an annular guide member 17.

Returning to Figure 1 there is shown in chamber 8 a rod 18 which engages diaphragm 5 by means of shoe 19. Shoe 19 is carried up and down by diaphragm as the pressure in pipe 3 varies, and rod 18 moving with shoe 19 is guided in annular guide 17.

The upper end of rod 18 is provided with lock nuts 20 (as shown in Figure 2 or similar rod 45) and freely sliding on rod 18 there is a sleeve 21. Rod 18, nuts 20 and cup 15 are made of non-magnetic material such as brass, while sleeve 21 is made of iron or steel.

In the top of cup 15 is a screw threaded socket 22. In Figure 1 an electrical switch housing 23 rests on an external annular shoulder of base 14 and is held down by acorn nut 24 threaded

on screw rod 25 the lower end of the screw rod screwing into socket 22.

Resting on the top of cup 15 and surrounding the threaded rod 25 is an annular disk of fiber 26 which provides an insulating electrical connecting block for electric cable 27 and electrical wires 28, 29 and 30. The plate 26 is held down by lock nuts 31'. Secured to the cup 15 by a split collar 31, 32 which is clamped together by screw 33, is a magnetic mercury switch 34. The switch 34 is pivoted at 35 and has an "Alnico" permanent magnet 36 secured to it rigidly. Also secured to it rigidly by bands 37 is a mercury switch 38 containing 2 drops of mercury, a large drop 39 and a small drop 40. Wires 28, 29 and 30 lead up into the drops of mercury in tube 38. The usual electrical conduit 41 may be provided to protect cable 27.

In Figure 2 member 3 is shown connected to a larger member 42 which may be the wall of a tank by means of nipple 43 which is welded at 44 to member 42.

Instead of a shoe 19 on the bottom of rod 18 as shown in Figure 1, in Figure 2 the rod 45 which corresponds to rod 18 is provided at its lower end with a float 46 which floats on the surface of liquid 47 in pressure chamber 8.

The operation of the device is as follows:

In Figure 1, fluid pressure on diaphragm 5 from the lower side will force rod 18 up into cup 15.

The pressure at which operations take place may be varied by adjusting screw 9 and by putting certain volumes of fluids in chamber 8 through conduit 10. The more fluid and the more screw 9 projects into the chamber 8, the higher the operating pressures.

In Figure 2 fluid pressure in the lower side of diaphragm 5 will raise the liquid level 47 raising float 46 and moving rod 45 into cup 15. The level of liquid 47 may be varied to adjust the height of 46 by additions or subtractions through conduit 10 and a gas under pressure may be placed over the liquid 47 in chamber 8 to increase the pressure necessary to operate the switch.

In both Figures 1 and 2, sleeve 21 is raised inside of cup 15, and sleeve 21 being of magnetic material will attract permanent magnet 36 through the brass cup 15. Magnet 36 moves nearer to and beside sleeve 21 turning the switch about pivot 35 and spilling the large drop of mercury from 39 over to 40. This connects wires 28 and 29 and disconnects wires 29 and 30.

As rod 18 or 45 descends when pressure on diaphragm 5 is reduced, sleeve 21 remains behind, stationary relative to magnet 36 until the upper lock nuts 20 strike the top of the sleeve and force the sleeve away from the magnet. Then the magnet no longer being attracted allows the mercury switch to fall back in the position shown in Figure 1. The space between nuts 20 allows sleeve 21 to have some free movement providing a predetermined range of pressures on diaphragm 5 without continually opening and closing switch 38.

It is therefore obvious that I have produced a novel and useful device for the transmission of pressure forces to switches, and obviously minor changes may be made without departing from my invention as set forth in the following claims.

Having described my invention, I claim:

1. A fluid pressure actuation means for an electrical switch comprising in combination a conduit for conducting a fluid under pressure, a rigid fluid tight chamber of limited volume having an open side communicating with the conduit, a flexible diaphragm across the open side of the chamber

forming a first sealing means for the conduit, rigid means separate from said diaphragm for varying the volume of the chamber, and electrical switch operating means carried by said flexible diaphragm, the contacts of said switch being exterior to said chamber, said chamber forming a second sealing means for the conduit and preventing the escape of fluid to said contacts upon failure of the first sealing means.

2. A fluid pressure actuation means for an electrical switch comprising in combination a conduit for conducting a fluid under pressure, a rigid fluid tight chamber of limited volume having an open side communicating with the conduit, a flexible diaphragm across the open side of the chamber forming a first sealing means for the conduit, means separate from said diaphragm for varying the residual air pressure in said chamber, and electrical switch operating means carried by said flexible diaphragm, the contacts of said switch being outside said chamber, said chamber forming a second sealing means for the conduit and preventing the escape of fluid to said switch contacts upon failure of the first sealing means.

3. A fluid pressure actuation means for an electrical switch comprising in combination a conduit for conducting a fluid under pressure, a rigid fluid tight chamber of limited volume having a single open side communicating with the conduit, a single flexible diaphragm across the open side of the chamber forming a sealing means for the conduit, a layer of liquid floating on the diaphragm, a float floating on the liquid, an electrical switch operating means carried by said float, said fluid in said conduit moving said operating means to a position which is a function of the pressure in said conduit.

4. A fluid pressure actuation means for an electrical switch comprising in combination a conduit for conducting a fluid under pressure, a rigid fluid tight chamber of limited volume having a single open side communicating with the conduit, a single flexible diaphragm across the open side of the chamber forming a sealing means for the conduit, a layer of liquid floating on the diaphragm, a float floating on the liquid, means for varying the air pressure in the chamber, and electrical switch operating means carried by said float, said fluid in said conduit moving said operating means to a position which is a function of the pressure in said conduit.

5. A magnetic pressure switch comprising in combination a conduit for conducting fluid under pressure, a flexible diaphragm sealing the conduit, a rigid means forming a closed fluid tight chamber having the flexible diaphragm as one wall thereof, a switch outside the conduit and the chamber, transmission means moved by the flexible diaphragm when changes in fluid pressure in the conduit moves the diaphragm, and magnetic means, comprising elements on the transmission means and the switch, operating through other walls of the chamber to throw the switch upon substantial change in fluid pressure, said chamber forming a second sealing means for the conduit and preventing the escape of fluid upon failure of said diaphragm.

6. The combination set forth in claim 3 in which an electrical switch disposed outside the conduit and the chamber and adjacent said chamber is actuated by said electrical switch operating means.

7. A fluid pressure operated safety switch for use with inflammable fluids comprising a conduit

for inflammable fluid under pressure, a body having a fluid tight chamber communicating with said conduit, a flexible diaphragm impervious to said fluid extending across said chamber and providing a space sealed from said fluid, magnetic means in said space moved by said diaphragm, and an electrical switch disposed outside said body adjacent said space, said magnetic means operating said switch by magnetic force through the fluid tight walls of said chamber in said body, 10

whereby said inflammable fluid cannot come in contact with said electrical switch even when said diaphragm fails.

8. The combination set forth in claim 7 in which the electrical switch is further enclosed in a sealed glass container whereby upon failure of said diaphragm and failure of said body said inflammable liquid is kept from contacting said switch by said glass container.

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