Aug. 29, 1950 H. L. BROUSE 2,520,525

MAGNETIC SWITCH

Filed April 1, 1948

FIG. 1

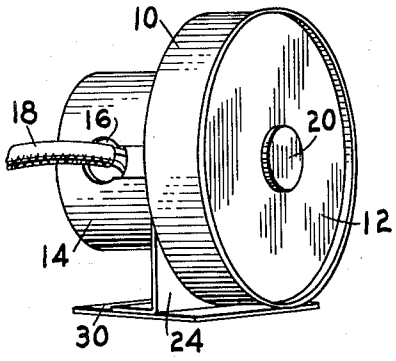


FIG. 2

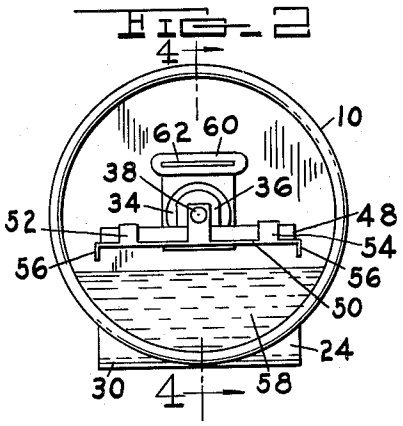


FIG. 3

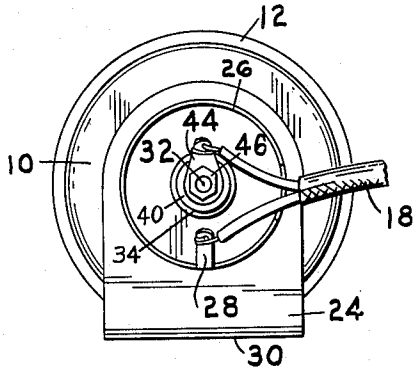
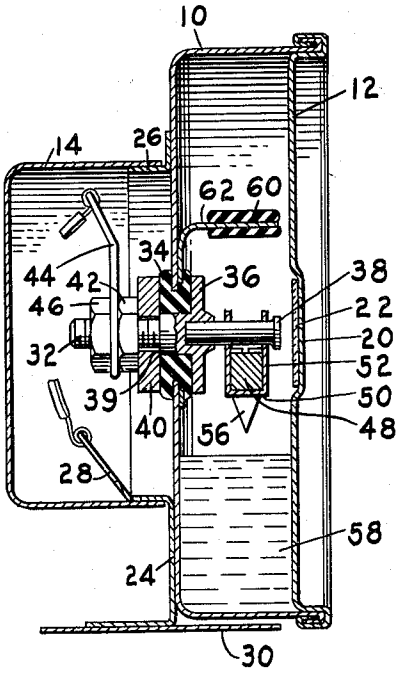


FIG. 4



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MAGNETIC SWITCH

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3 Claims. (Cl. 200—112)

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This invention relates to switches and more particularly to switches of the magnetically operated type.

An object of the present invention is to provide a magnetically operated switch having a high degree of sensitivity and a relatively large operating range.

Another object of the invention is the provision of a switch of the magnetic type especially adapted for underground use.

A further object of the invention is to provide a hermetically sealed magnetically operated switch suitably adapted for use under extreme conditions of temperature and humidity.

A still further object of this invention is to provide a mercury switch so constructed that the operating efficiency and life expectancy is in no way affected by the presence of the mercury.

Other objects and advantages of the invention will appear upon a thorough consideration of the following detailed description composed with reference to the drawings which constitute a portion of this specification and in which:

Fig. 1 is a perspective view of a switch embodying the instant invention.

Fig. 2 is a front elevation view of the switch with the front cover removed.

Fig. 3 is a rear elevational view of the switch with both the terminal cover and the asphalt packing removed.

Fig. 4 is a vertical sectional view taken substantially on line 4—4 in Fig. 2 with both covers in place.

In Fig. 1 numeral 10 designates a switch case of non-magnetic and chemically inert conductive material such as stainless steel, having a front cover 12 and a terminal cover 14 provided with an opening 16 for the reception of a dual conductor cable 18. The front cover 12 has an outwardly deformed central portion 20 coated on the inside surface with a suitable insulating compound 22, such as plastic adhesive, and rolled along the outer edge thereof into a locking and sealing engagement with the rim of the case 10.

The case 10 is soldered, or otherwise mounted, on a footed bracket 24 having an outstanding annular flange 26 for supporting the terminal cover 14 and providing a case connection terminal 28. The foot of the bracket 24 is welded, or otherwise secured, to a plate 30 so as to provide a convenient base for mounting the switch in an upright position.

An elongated non-magnetic stud 32, of stainless steel or other suitable conductive material, is mounted centrally in the rear wall of the casing 10 and fixedly held at substantially right angles thereto by a sealing and insulating grommet 34, of an inert resilient material such as a type of chlorinated synthetic elastomer. That portion of the stud 32 within the casing 10 is provided with an annular flange 36 seated against the inner face of the grommet 34 and drilled axially to receive, in a press fit, a non-magnetic pin 38,

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of suitable conductive material, having an enlarged retaining head on the free end thereof.

That portion of the stud 32, outside the case 10, is decreased in cross section to provide an annular shoulder 39 adjacent the grommet 34 for seating a non-magnetic spacer bushing 40 adapted to imposed a predetermined amount of compression on the resilient grommet 34. The smaller portion of the stud 32 is threaded to receive a nut 42 for holding the spacer bushing 40 in seat against the shoulder 39 and providing lateral support for a central terminal connector 44 locked on the stud by a retaining nut 46. A bar magnet 48 of high permeability material is mounted in a non-magnetic cradle 50 which is suspended centrally from the pin 38 for balanced rotation thereabout within predetermined angular limits.

The magnet 48 is bonded in the cradle 50 by a suitable cement and further secured therein by means of clips 52 and 54, provided on either end of the cradle 50, and turned down over the top of the magnet 48. The cradle 50 also has a triangular shaped contact point 56, dependent from each end thereof, adapted to make contact with a pool of suitable conductive liquid 58, such as triple distilled mercury, when the cradle and magnet assembly is rotated a predetermined distance in either direction.

The rotational limits of the cradle assembly are defined by a cushion stop comprising a section of resilient tubing 60, such as rubber, fitted over a laterally extended bracket 62 supported by a downturned foot wedged between the rear wall of the case 10 and the inner flange of the grommet 34.

The cushion stops, by defining the limits of travel in either direction, prevent the cradle assembly from rotating, under the influence of a strong magnetic field, so as to cause the contacts 56 to float inverted on the surface of the mercury pool rather than remain immersed.

This completes a discussion of the structural details of the invention; however, to facilitate a better understanding of the subject matter involved, a brief discussion will be directed to the manner in which the switch is assembled and the way in which it operates to perform its intended function.

In assembling the switch it is extremely important to remove as much moisture as possible from the air within the casing so as to prevent oxidation of the parts. This reaction, by way of illustration, will occur readily at a temperature of 100° F. and relative humidity of 45 percent. However, at this same temperature, the relative humidity must be constantly maintained below 15 percent to avoid the possibility of such oxidation.

This undesirable oxidation, as well as mercury pollution, result from the presence of greases and various soldering or welding fluxes present on certain of the component parts. It is, therefore, essential that the case be washed in boiling wa-

ter after soldering so as to remove all excess flux. It is also advisable to immerse all parts in a suitable degreasing solution and then adopt measures in assembling the switch to prevent any deposition of greases on either the enclosed working parts or the surfaces defining the enclosure.

After the working parts of the switch have been assembled within the case, the assembly is placed in a dehydrated atmosphere so as to charge the case with moisture-free air. If it is deemed advisable, the case may be charged with a gas such as nitrogen or hydrogen so as to reduce further the possibility of corrosion and chemical activity. Caution must also be exercised so as to select substantially chemically inert materials to be used for the fabrication of those elements in the switch which are normally exposed either to the conductive liquid or its vapors when a chemically active substance like mercury is employed.

Before the front cover 12 is placed on the case 10, however, a thin coating of a suitable rubber cement is preferably applied to the engaging or mating surface thereof and permitted to dry at a temperature slightly above the boiling point of water so as to evaporate any moisture present. The front cover 12 is then rolled into sealing and locking engagement with the rim of the case 10 by any convenient means such as that employed by commercial canneries in sealing metal food containers. Leads from the conductor cable 18 are then soldered, or otherwise connected, to the casing and central terminals 28 and 44, respectively, after which the terminal cover 14 is potted with an impervious insulating compound, such as melted asphalt and forced in place over the terminals.

The casing is thus hermetically sealed, thereby making the switch especially well adapted for use in installations which are constantly subjected to varying extremes of temperature and moisture. Therefore, barring damage to the switch caused by impact or overload, repeated tests have shown that the device will function indefinitely without any loss in sensitivity or efficiency.

In operation the switch is placed in an upright position on the base 30 so that the cradle 50 is free to pivot about the pin 38. Therefore, when the magnet 48, carried by the cradle 50, is exposed to a magnetic field of sufficient intensity, the forces of attraction and repulsion are effective to rotate the cradle assembly so that one or the other of the triangular contact points 56 will become immersed in the mercury and thereby complete the circuit between the central terminal 44 and the case terminal 28.

The switch will remain in this closed position until the strength of the magnetic field is reduced to a predetermined intensity, at which time the cradle assembly will rotate about the pin 38 toward a horizontal position, and in so doing breaks contact between the mercury pool 58 and the immersed triangular contact point 56. This opens the switch, and consequently any circuit in which it is connected, until it is again caused to close in one direction or another under the influence of a magnetic field of sufficient intensity as above described.

One use of the switch as contemplated by the applicant, is in conjunction with automatic garage door operating equipment. In this connection, the switch may be installed in the ground beneath a driveway so as to be within the operating range or influence of a magnetic coil mounted on the under side of an automobile or other similar vehicle. In such an installation, the driver would energize the coil temporarily by means of the car battery as the vehicle is passing over the underground magnetic switch. This would cause the switch to close so as to complete a circuit for the actuation of the door control mechanism.

While this invention has been described with reference to the details of a single embodiment and adaptation, it will be appreciated by those skilled in the art that the principles involved, as well as the device itself, are susceptible of numerous other applications.

Therefore, what I claim and desire to secure by Letters Patent is:

1. A magnetic switch comprising, an electrically conductive non-magnetic and hermetically sealed case, a conductive terminal stud having a threaded section on one end and a seating flange on the other end mounted in one side of the case, insulating means including a resilient grommet sleeved around the stud and seated against the stud flange, adjustable means for cooperation with the threaded section to compress the grommet a predetermined amount into a sealing engagement with the case, a conductive cradle in the case mounted for limited rotation on the stud, a permanent magnet mounted centrally in the cradle, and a pool of conductive liquid in the case adapted to immerse one end or the other of the cradle and magnet assembly as it rotates in response to a magnetic stimulus.

2. A magnetically operated switch comprising, an electrically conductive non-magnetic and hermetically sealed case, a conductive terminal stud having a threaded section on one end and a seating flange on the opposite end mounted in one wall of the case by adjustable means including a resilient insulating grommet sleeved on the central portion of the stud and seated on one end against the stud flange, and non-magnetic means for cooperation with the threaded section on the terminal stud to compress the grommet a predetermined amount into a sealing engagement with the case, a conductive cradle in the case mounted for limited rotation on the terminal stud, a permanent magnet mounted centrally in the cradle, and a pool of conductive liquid in the case adapted to immerse one end or the other of the cradle and magnet assembly as it rotates in response to a magnetic stimulus.

3. In a magnetic switch having a sealed case containing an electric conducting liquid and a conductor member above the level of the liquid, a tiltable cradle to receive and hold a bar magnet comprising, an elongated sheet metal base to support the magnet, a pair of oppositely disposed tabs on said base adjacent each end thereof and bendable over a bar magnet to retain the same, a pair of oppositely disposed pivot members on said base intermediate said pairs of tabs to receive the conductor member, and bent end portions of said base forming contacts for immersion in the electric conducting liquid in the case.

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