Dec. 13, 1949 C. BELSKY 2,491,075

MAGNETIC SWITCH

Filed May 3, 1945

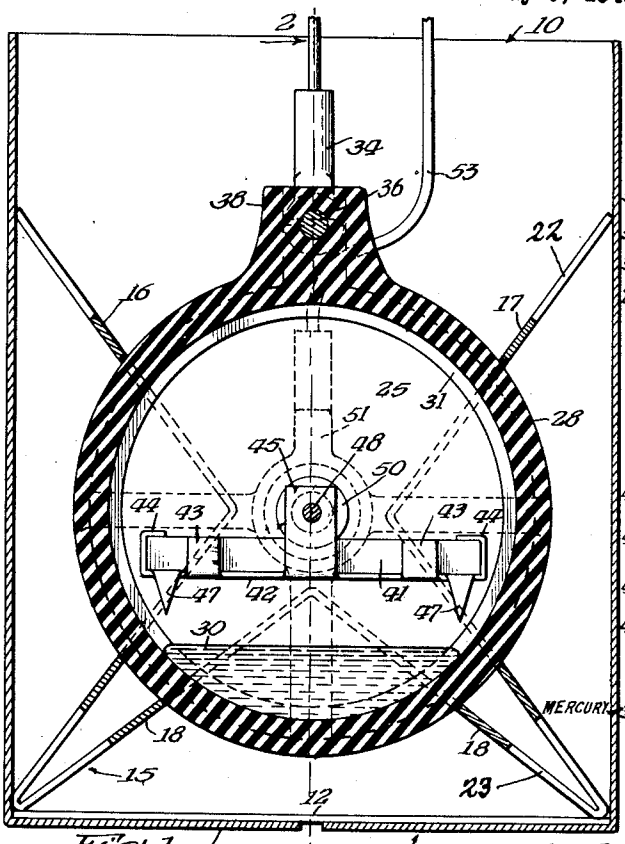


Fig. 1

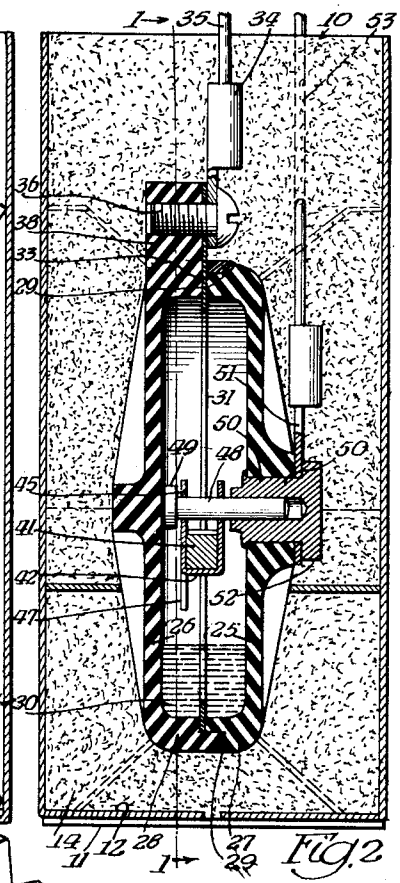


Fig. 2

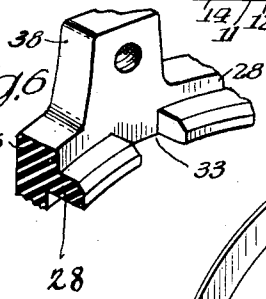


Fig. 6

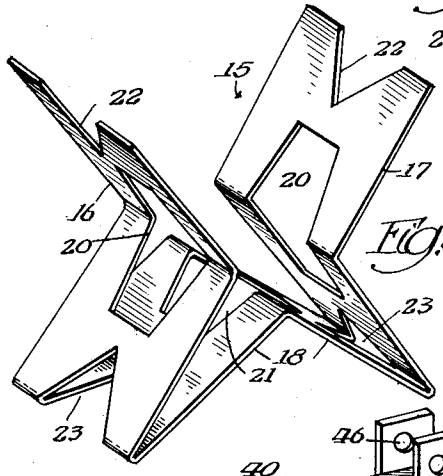


Fig. 3

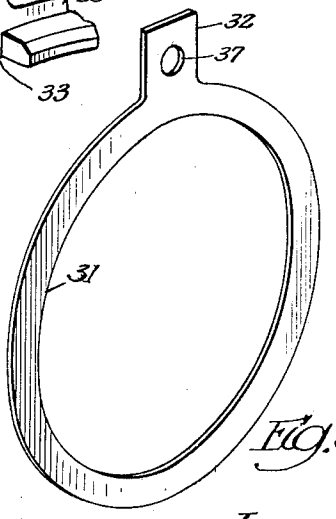


Fig. 5

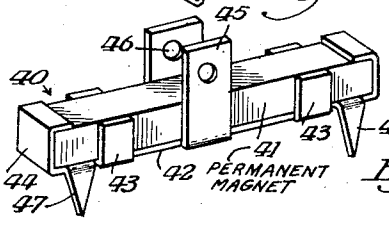


Fig. 4

Inventor
Charles Belsky
By Fred Yurlash his Atty

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MAGNETIC SWITCH

Charles Belsky, Detroit, Mich., assignor, by mesne assignments, to Robot Appliances, Inc., Detroit, Mich., a corporation of Michigan

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3 Claims. (Cl. 200—112)

1

The invention relates to magnetic switches.

One object of the invention is to provide an improved magnetic switch of the type which is responsive to changes in the distribution of flux resulting from an approaching automobile, for controlling an electrical circuit for operating an electrically actuated door operating mechanism or other electrically operable means.

Another object of the invention is to provide an improved switch of this type which is adapted to be installed in the ground.

Another object of the invention is to provide an improved magnetic switch which is simple in construction and can be economically fabricated.

Another object of the invention is to provide an improved switch of this type which comprises simple and inexpensive means for positioning the switch-casing in a box while it is filled with pitch or other suitable mass for excluding moisture from the switch.

Another object of the invention is to provide an improved switch which may be placed in a multiplicity of positions for operation.

Other objects of the invention will appear from the detailed description.

The invention consists in the several features hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings:

Fig. 1 is a section taken on line 1—1 of Fig. 2.

Fig. 2 is a section taken on line 2—2 of Fig. 1.

Fig. 3 is a perspective of the retainer for positioning the switch-casing in the enclosing box while the casing is being filled with the waterproofing mass.

Fig. 4 is a perspective of the switch-lever and the magnet thereon.

Fig. 5 is a perspective of the annular electric conductor which contacts the pool of mercury in the casing and connected to one of the conductors of the circuit controlled by the switch.

Fig. 6 is a perspective of a portion of one of the casing sections.

The magnetic switch comprises a box 10 which is adapted to be buried in the ground or roadway, and in which the casing containing the switch-parts is embedded, in a suitable mass or filling 14, such as pitch, for excluding moisture from the inside of the casing. The box may be formed of a single piece of suitable material, such as sulphate kraft paper, bent to form the ends and sides and infolded and overlapping integral flanges 11 and 12 which form the bottom of the box.

In practice, it is advantageous to position and

2

retain the switch-casing in the box so that it will be completely surrounded by the mass 14, particularly while the mass in a fluid state is poured into the box around the assembled switch and after the conductors to the circuit to be controlled by the switch have been connected to the switch-elements in the casing. This retainer, generally designated 15, consists of a single strip of material, such as heavy kraft paper or cardboard of sufficient stiffness to support the casing, bent to fit in the box and provided with openings for receiving and retaining the switch-casing. This strip is bent to form a pair of V-shaped sides 16 and 17 and a V-shaped bridge 18. The lower members of the sides 16, 17 and the V-shaped bridge 18 form diagonal legs which extend into the lower corners of the box and the upper members of the sides 16 and 17 extend diagonally from the legs to the upper portions of the sides of the box. The side edges of the strip fit the sides of the box.

Slots 20 are cut in the inner portions of the V-shaped sides 16 and 17 and a slot 21 is cut in the upper portion of bridge 18, into which the casing fits and whereby the casing will be positioned in the central portion of the box where it will be completely surrounded by the filler mass 14. V-shaped notches 22 are cut in the upper members of the V-shaped sides 16, 17 and notches 23 are cut in the lower members of sides 16, 17 and the upper portion of the bridge 18 to provide passages through which the pitch will flow under and around all sides of the switch-casing.

The switch-casing comprises a pair of generally circular cup-shaped sections 25 and 26 with sides and inwardly extending confronting rims 27 and 28 and is formed of plastic insulating material, such as "bakelite." The rims 27, 28 of sections 25, 26 are formed to interfit and overlap and are sealed together. The mating faces of rims 27, 28 are chamfered to form a V-shaped substantially angular groove which is filled with a plastic adhesive 29 for forming a tight seal between, and also securing together, the casing sections. This avoids the use of screws for securing the casing sections together. The lower portion of the chamber in the casing contains a pool of mercury 30. A conductor-ring 31, preferably formed of stainless non-magnetic steel, has its outer marginal portion fitting and confined between the faces of the interfitting portions of rims 27, 28 and its inner portion projects into the chamber in the casing for contacting the pool 30 of mercury. Ring 31 is provided with an outwardly projecting lug or extension 32 which extends through a notch

33 cut in the rim of casing section 26 for connection to a terminal clip 34 of a conductor 35. A screw 36 extends through the terminal, a hole in lug 32 and into an integral outward extension 38 on casing section 26. Ring 31 forms an electric conductor between the mercury 30 and terminal clip 34.

A lever, generally designated 40, is preferably formed of stainless sheet steel, and is centrally pivoted on a pin 48 so it will be in balanced suspension over the pool of mercury 30. A permanently magnetized bar 41 is secured on lever 40, for shifting it. Switch-lever 40 comprises a strip 42 which underlies the magnet bar 41, upstanding integral tongues 43 between which bar 41 is confined against transverse movement, tongues 44 bent around and over the ends of bar 41 for holding said bar against endwise movement on the lever 40, central upstanding tongues 45 which are provided with co-axial holes 46 through which fulcrum pin 48 extends for pivotally supporting the lever, and pointed depending tongues 47, one of which, when the lever 40 is tilted in either direction, will dip into the pool of mercury 30 for closing the switch. Pin 48, preferably formed of stainless steel, is provided in its inner end with a head 49, and its stem is held in a cap 50 which extends through the central portion of the side of casing section 25. Cap 50 is preferably formed of stainless steel. A terminal clip 51 is confined between an annular shoulder 52 on cap 50 and the outer side of casing section 25 and is connected to a conductor 53 of the circuit to be controlled by the switch. Cap 50 has its inner end spun to hold it in casing section 25 and is sealed in said section with a plastic adhesive. The adhesive 29 extends into notch 33 in casing section 26 to the outer face of ring 31.

In fabricating the switch, cap 50 is secured in the casing-section 25 with the terminal 51 confined between the cap and said section. The pin 48 is inserted through tongues 45 to connect the lever 40 to section 25. The mercury 30 is poured into section 26 while it is horizontal and sections 25 and 26 are assembled together with ring 31 between them. The casing is then closed by placing the plastic adhesive 29 of sealing material in the peripheral V-shaped groove between said sections so they will be secured and sealed together. The terminal clip 34 may then be secured by screw 36 in contact with the extension 32 on casing section 26. The retainer 15 is then placed around the casing so it will be confined in slots 20 and 21 of the retainer and the assembled casing and retainer are placed in the box. The casing will be centrally positioned in the box. The pitch is then poured into the box until it is filled. The pitch will flow completely around the switch casing, the terminal clips 34, and the portions of the conductors 35 and 53 in the box to protect the switch from moisture in the ground in which the box is usually installed.

The operation of the switch is as follows: The balanced bar-magnet 41 and lever 40 are normally freely suspended from pivot-pin 48, for swinging movement, in opposite directions from their horizontal position and both of the contact-points 47 are then withdrawn from the pool 30. The circuit between outside conductors 35 and 53 will then be interrupted between pool 30 and contact points 47.

The bar-magnet 41 is surrounded by a powerful magnetic field projecting into the space above ground level. When a vehicle which is made in part, of magnetic material, approaches the switch, it affords a low resistance path for this magnetic field through its metal parts and thereby creates an attraction between itself and one end of the bar-magnet. This attraction causes lever 40 to swing from its normal horizontal position, until one or the other of the contact points dips into the pool of mercury. The end of the bar-magnet 41 nearest the approximate magnetic center of the vehicle, will be lifted, while the opposite end of the lever 40 is lowered to shift its contact 47 into the pool of mercury. This will close the following circuit: conductor 35, clip 34, ring 31, cap 50, clip 51 and conductor 53. The balanced magnet and lever are freely and centrally suspended, so that one of their ends is movable upwardly while their opposite end moves downwardly. As a result, either end of the bar-magnet may be attracted upwardly by the vehicle to lower the contact point 47 at the opposite end into the pool, to close the circuit. In this construction, the single lever and magnet will function to close the switch when a vehicle is travelling in the magnetic field, at either side of the switch, or is approaching and travelling away from the switch. The lever and bar being balanced and suspended from pin 48, are extremely sensitive to the attraction of the vehicle. The lever 40 will remain shifted and keep this circuit closed until the moving vehicle passes out of the magnetic field, whereupon the attraction between the vehicle and the bar-magnet will cease and lever 40 and said magnet will swing back to their balanced or horizontal position and withdraw the submerged contact point 47 from the pool of mercury to open said circuit.

The switch is particularly adapted for installation in the ground for operation responsively to the approach of a vehicle which is made in part, of a magnetic material. A characteristic of the invention is that the switch-box, with the casing therein, need not be installed in the ground with accuracy to maintain the casing in a vertical plane, for the movement of the switch-lever by gravity and maintaining its operative relation with the pool of mercury. For example, the box may be installed in different angular positions in the ground while its sides are vertical or the axis of pin 48 remains horizontal, because the operative relation of the mercury and lever will be maintained, because the pool of mercury is free to flow by gravity circumferentially to the lowest portion of the chamber in the casing and lever 40 will remain free to swing by gravity into parallelism with the top surface of the pool of mercury in different circumferential proportions of said chamber. This relationship will be maintained even if the box is installed so the conductors 35, 53 lead laterally to the box or the sides of the box extend horizontally in the ground so long as the axis of pin 48 remains substantially horizontal. In all positions the lever 40 will be pivotally suspended so it will normally remain parallel with the surface of the liquid, and the contact points 47 will be positioned for closing the circuit between the lever and the mercury when magnet 41 is influenced by attraction from an external source. The box may also be positioned in the ground with limited transverse angular variation. For example, until the box is angularly disposed in the ground so the axis of pivot pin 48 is inclined from the horizontal nearly 30 degrees, the lever will remain

free for pivotal movement to its normal position by gravity and to close the circuit when the magnet 41 is attracted out of its balanced or normal position. These attributes are advantageous, particularly when the box is installed under a concrete roadway through a small tunnel or elongated opening where inaccessibility and necessity for packing the soil around the box make it difficult to accurately position the box in the ground. Furthermore, after installation, the box is sometimes displaced by frost or other ground conditions, and when this occurs, the operative relation of the switch-lever and mercury will be maintained.

The invention exemplifies a magnetic ground switch with a casing formed of sections sealed together with a conductor-ring between them. The invention includes a retainer for the casing with a filler mass poured into the box to completely surround the casing. The switch-lever may be formed of sheet metal and with integral contacts and magnet retaining tongues. The invention also exemplifies a magnetic switch of this type which is simple in construction and is effectively protected against short circuiting by seepage of moisture from the ground from which the switch is embedded.

The invention is not to be understood as restricted to the details set forth, since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. A switch comprising: a casing including a pair of sections having sides and annular mating, substantially cylindrical rims secured together, defining a closed, substantially cylindrical chamber containing a pool of conductor liquid; a pivot pin co-axial with, and substantially horizontally disposed in, the chamber; a balanced lever pivotally supported by said pin and free, for tilting movements in opposite directions from its normal horizontal position and provided with contacts at its opposite ends normally out of and movable respectively into the liquid upon swinging movements of the lever in opposite directions, a balanced, permanent magnet on the lever responsive to attraction caused by magnetic objects approaching the switch in different directions and adapted to shift the lever in opposite directions, an annular conductor element extending into the liquid in said chamber and confined between the casing sections, and provided with a connection to the outside of the casing, said pin and lever being connected for electrical conduction, a conductor connected to said connection, a second electrical conductor on the outside of the casing and electrically connected to the pivot pin, the annular element extending circumferentially around the chamber for maintaining operative contact between said element and the liquid, when the switch is installed with the pool in different circumferential portions of the chamber.

2. A switch comprising: a casing including a pair of sections having sides and annular mating, substantially cylindrical rims secured together, defining a closed, substantially cylindrical chamber containing a pool of conductor liquid; a pivot pin co-axial with, and substantially horizontally disposed in, the chamber; a balanced, freely suspended lever pivotally supported by said pin, for tilting movements in opposite directions from its normal position and provided with contacts at its opposite ends, normally out of and movable respectively into the liquid upon swinging movements of the lever in opposite directions, a balanced, permanent magnet on the lever responsive to attraction caused by magnetic objects approaching the switch in different directions and adapted to shift the lever in opposite directions, a conductor ring extending into the liquid in said chamber and confined between the rims of the casing sections, and provided with an integral extension to the outside of the casing, said pin and lever being connected for electrical conduction, an annular seal between the rims of the casing sections outwardly of the ring, a conductor connected to said extension, a second electrical conductor on the outside of the casing and electrically connected to the pivot pin, the conductor element extending circumferentially around the chamber for maintaining operative contact between said element and the liquid, when the switch is installed with the pool in differential circumferential positions in said chamber.

3. In a magnetic switch, a pair of casing sections forming a chamber, a liquid electric conductor in said chamber, an electric conducting member extending into said casing, an electric conducting switch member pivotally supported on said conductor member within said chamber, a bar magnet carried by said switch member, said bar magnet normally being balanced on said conductor member above the level of said electric conducting liquid, a downwardly directed contact carried by said switch member on each side of the fulcrum thereof, and an electric conductor ring held by and between said casing sections in contact with said liquid conductor and in the plane of tilting of said pivoted switch member.

CHARLES BELSKY.

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