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2,498,683

MAGNETICALLY OPERATED SWITCH

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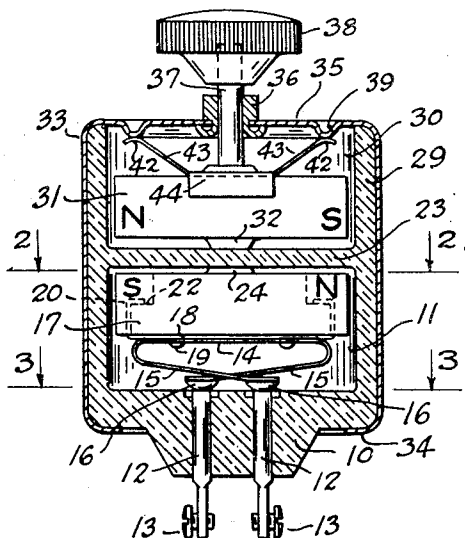


Fig. 1.

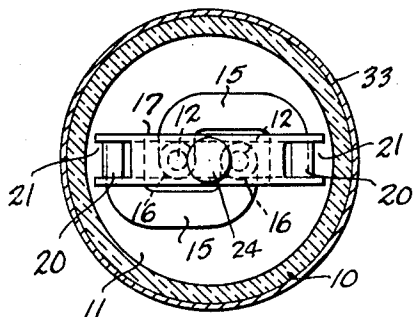


Fig. 2.

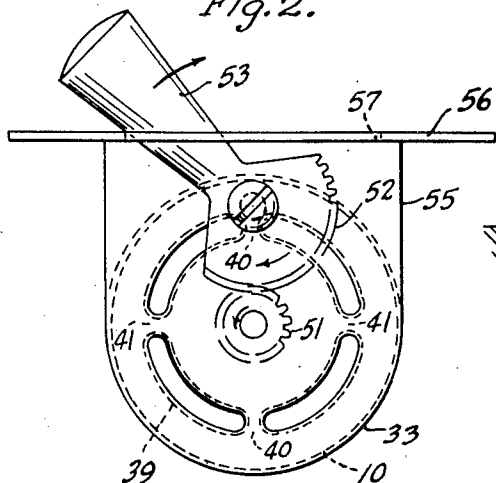


Fig. 3.

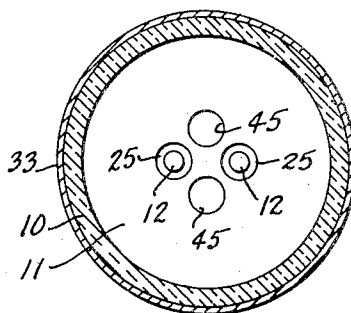


Fig. 4.

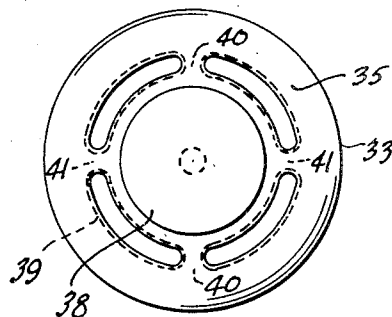


Fig. 5.

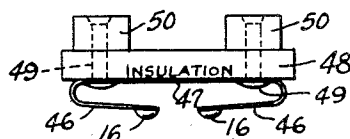


Fig. 6.

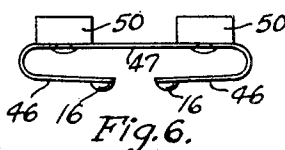


Fig. 7.

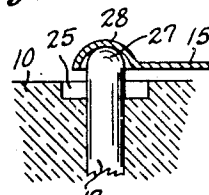


Fig. 8.

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MAGNETICALLY OPERATED SWITCH

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6 Claims. (Cl. 200—155)

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This invention relates to electrical switches, and has for an object to provide an improved and simplified construction of switch in which there is no direct connection between the movable switch element and the operating means, but the switch is operated magnetically and may or may not be enclosed in a sealed chamber, as desired.

It is also an object to provide such a construction in which the switch operating or control means may be located outside the sealed chamber enclosing the movable and stationary contacts, and the contacts may therefore be sealed and the device used in an explosive atmosphere and with no danger of igniting surrounding objects by arcing incident to make and break of the circuit.

With the foregoing and other objects in view I have devised the construction illustrated in the accompanying drawing forming a part of this specification. It is, however, to be understood the device is not limited to the specific details of construction and arrangement shown, but may embody various changes and modifications within the scope of the invention.

In this drawing:

Fig. 1 is a longitudinal section through the device;

Figs. 2 and 3 are transverse sections substantially on lines 2—2 and 3—3 respectively of Fig. 1;

Fig. 4 is a top plan view;

Figs. 5 and 6 are side elevations of movable switch contacts and the mounting means showing slight modifications;

Fig. 7 is a section of the stationary contact with a movable contact shown in elevation;

Fig. 8 is a similar section showing a slight modification, the stationary contact being in elevation and the movable contact in section, and

Fig. 9 is a plan view showing a modified means for operating the switch.

The switch construction, shown by way of example, comprises a body 10 of glass or other suitable molded insulating material enclosing a chamber 11, which may be a sealed chamber if desired, with conductors 12 molded in the glass or other insulating material extending to this chamber and with their inner ends forming or connected with stationary contacts. Means may be provided outside the chamber for connecting lead wires to these conductors, such for example as the usual binding screws 13. Mounted in the chamber 11 is a movable contact member 14 comprising spring arms 15 having substantially semi-spherical ends 16 to engage the stationary con-

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tacts and to bridge these contacts to close the circuit. This movable contact member is mounted on a free floating permanent magnet 17 and may be secured thereto by any suitable means. In the construction shown it is connected to a metal strip 18 of conducting material by any suitable means such as the rivets 19, and the ends of this strip as indicated at 20 extend upwardly in notches 21 in the opposite ends of the magnet 17 and are each folded over onto a top wall 22 in this notch forming a shoulder to retain the contact in place. The spring arms 15 support the magnet and hold it against the top wall 23 of the chamber. To reduce friction against this wall and permit the magnet to turn more freely, the magnet may have a central boss 24 on its top wall engaging the wall 23.

Preferably, the stationary contacts, whether formed by the upper ends of the conductors 12 or separate contacts connected therewith, are located in surrounding recesses 25 in the bottom wall of the body member 10, and the top surface 26 may be concaved, as shown in Fig. 7, so that the semispherical contacts 16 may seat therein and be held by coaction between the two with the contacts in engagement to keep the circuit closed and prevent ordinary jarring separating them. If desired, the contacts may be reversed, as shown in Fig. 8, in which case the upper end 27 of each conductor 12 forming the stationary contacts is rounded or semispherical in shape, and the movable contact 28 is reversed so that the concave side may rest on this rounded end to retain the contacts in engagement. The rounded shape of the contacts 16 or 27 permits the movable contacts to slide more readily to and from the stationary contacts.

The side walls of the body 10 may be extended above the top wall 23, as indicated at 29, to form a second chamber 30 in which is mounted a control or operating magnet 31. The two magnets 17 and 31 are preferably rectangular, straight, permanent bar magnets, and may be made of any suitable magnetic material, but preferably of some of the new alloys which will retain a high degree of magnetism for an indefinite period, such for example as "alnico." The magnet 31 is also mounted to rotate in the plane of the magnet and parallel to the plane of the magnet 17, and it is located closely adjacent the upper side of the top wall 23, but, if desired, in order to reduce friction against this wall, it may have a central boss 32 on its under side to engage the wall and space the magnet a short distance therefrom. The top or open side of the cham-

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ber 30 is closed by a metal housing 33 which also encloses and protects the sides of the body 10 and may be secured to the body by turning in the lower edges of the side walls over the lower end of the body, as indicated at 34. Mounted in the top wall 35 of the casing is a bearing sleeve 36 for a rotatable shaft 37 connected to the magnet 31 for turning the magnet. Any suitable means may be provided for turning the shaft and magnet, such for example as a hand knob 38 secured to the shaft, and preferably made of some molded insulating material, such, for example, as "bakelite."

Means is provided for retaining the control magnet 31 in different angular positions in its plane of rotation. For this purpose an inwardly extending bead 39 is formed on the inner side of the top wall 35, but the bead is made in segments as indicated in Fig. 4, with seats or gaps 40 and 41 between them in which may seat the transversely rounded feet 42 of spring arms 43 carried by the magnet and shaft 37 to rotate therewith. As these feet run into these notches or gaps 40 and 41 they will yieldingly retain the control magnet 31 in different positions at 90 degrees to each other. The arms 43 may extend outwardly and upwardly in an inclined position from a substantially U-shaped inverted body portion 44 seated on and embracing the magnet 31 so as to rotate with it. As shown in Fig. 3, although the stationary contacts formed on the upper ends of the conductors 12 are arranged in recesses 25 in diametrically opposite positions, similar recesses 45 are arranged at ninety degrees to these first recesses with no contacts in them to permit the movable contacts 16 to rest in them when the switch is in the off or open circuit position, and to yieldingly retain the contacts in this position until operated by shifting the magnet 31.

In Fig. 5 is shown a slightly modified construction of the lower or floating magnet. In this construction the movable contacts 16 are mounted on inwardly bent spring arms 46 of a conductor strip 47 secured to the under side of a bar 48 of insulating material by any suitable means such, for example, as the rivets 49. On the outside of the bar 48 are secured two spaced blocks 50 of magnetic material, as soft iron, or permanent magnets, to cooperate with the control magnet 31 for shifting the contacts 16.

In Fig. 6, instead of using the intermediate bar 48 of insulating material, the magnetic blocks of soft iron or magnets 50 are mounted directly on the conductor strip 47.

In Fig. 9 is shown a slightly different means for operating the control magnet 31 for controlling the switch. In this case, mounted on the shaft 37 is a small gear 51 meshing with a segment gear 52 formed with a hand lever 53 pivoted at 54. In this case the casing 33 embracing the body member is provided with a lateral extension 55 having a flange 56 by which the whole device may be mounted in any suitable support, lever 53 operating in a slot 57 in this flange. It will be seen that by swinging the lever 53 back and forth, the gears 52, 51 will turn the control magnet 31 through a quarter revolution to shift it between the off and on positions.

In operation, with the switch in the closed position of Figs. 1 and 2 and the movable contacts 16 engaging the stationary contacts at the inner end of the conductors 12, the two magnets 17 and 31 are in substantial alignment and in substantial parallel relation in adjacent laterally spaced parallel planes. The feet 42 of the spring arms 43

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will be seated in the notches 41 of the bead 39 to retain the magnet 31 in this position. As the north and south poles of the control magnet 31 are adjacent the opposite or unlike south and north poles, respectively, of the free floating magnet 17, they will attract each other and the magnet 17 will be held in the parallel relation to magnet 31. If now the control magnet 31 is rotated in the plane of this magnet by the operating means, such as the knob 38 or the hand lever 53, the floating magnet 17 will turn with it in its plane parallel to the plane of the magnet 31, as the north and south or unlike poles, being adjacent, attract each other. If the magnet 31 is turned ninety degrees to the position of Figs. 1 and 2, the magnet 17 will follow with it, shifting the movable contacts 16 from the stationary contacts to the recesses 45, Fig. 3, thus opening the circuit. During this movement the spring arms 43 move with the magnet 31 along the top of the bead 39 and in this new or intermediate position the feet 42 will seat in the notches 40, retaining the magnet 31 in this position, and the switch in the open position. To close the switch again, magnet 31 is merely turned ninety degrees in either direction to bring it to the position of Fig. 1, causing the magnet 17 to follow with it and bring the movable contacts 16 into engagement with the stationary contacts, or with the operating means of Fig. 9 the lever is merely swung in the opposite direction. As shown more clearly in Fig. 1, the spring arms 15 of the movable contact may cross or be extended beyond each other so that each contact 16 engages the stationary contact nearest the opposite end of the bar 17. This permits the use of a longer spring arm giving a more yielding and flexible arm.

It will be seen from Figs. 7 and 8 that the cooperation of the concave stationary contact 26 with the convex contact 16 carried on the spring arms 15 will yieldingly hold them in engagement against accidental separation, supplementing the action between the two magnets 17 and 31. In the form of Fig. 8, the rounded end 27 of the stationary contacts, seating in the concave side of the movable contact 28, will have the same effect.

In the forms of Figs. 5 and 6 the magnetic soft iron blocks 50, or if they are made of permanent magnets, will follow the control magnet 31 the same as will the form of the device shown in Figs. 1 and 2, but if the magnetic elements connected with the movable contacts are permanent magnets, as indicated in Fig. 1, there is greater mutual attraction between them and the control magnet, giving more positive operation.

It will be seen from the above that this makes a very simple construction, involving a minimum number of parts; also that the movable and stationary contacts may if desired be mounted in a sealed chamber so that they are cut off from surrounding atmospheres, permitting use of this switch with perfect safety in explosive atmospheres and also preventing any possibility of igniting adjacent elements, and the switch may be operated by a control member located entirely outside the sealed chamber with no mechanical connection between them.

Throughout the specification and claims the term "magnetic material" is used in a generic sense to indicate a material which is affected by magnetic action whether it is sufficiently hard or retains sufficient magnetism so that the member made of it is itself a permanent magnet, or it is soft iron or some other material which is affected by another magnet but itself does not retain suf-

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ficient magnetism so that the member made of it would be called a magnet when not under the influence of the other magnet.

Having thus set forth the nature of my invention what I claim is:

1. An electric switch comprising a body member of insulating material enclosing a chamber, a pair of permanent bar magnets located one on each of the opposite sides of the upper end wall of the chamber adjacent thereto and adapted to rotate in planes substantially parallel to said wall, a contact connected to said inner magnet and including spring fingers located under the magnet to support it and provided with contacts on the lower end wall of the chamber, stationary contacts in said latter wall arranged to be bridged by said movable contact, and means for rotating the outer magnet to cause the inner magnet to move with it by mutual attraction between the magnets to shift the movable contact.

2. An electric switch comprising a permanent bar magnet mounted to turn in the plane of the magnet, a free floating element of magnetic material located adjacent the magnet and adapted to turn in a plane substantially parallel with the magnet, a body provided with a chamber in which said element is located, a movable contact connected with said element to move therewith and including yieldable spring contact fingers engaging a wall of the chamber to support and position the element, a stationary contact toward and from which the first contact moves, and means for turning the magnet to shift the element by mutual magnetic action between them to shift the movable contact.

3. An electric switch comprising cooperating stationary and movable contacts, a control magnet comprising a straight bar mounted to turn in the plane of the magnet, a member of magnetic material connected to the movable contact, said member an contact being enclosed in a chamber and free floating so as to be movable in a direction normal to the plane of the magnet and free to turn in a plane adjacent and parallel to the plane of the magnet, and means for rotating the magnet to cause the member and contact to turn with it.

4. An electric switch comprising a body of insulating material enclosing a chamber, a bar of magnetic material located in the chamber adjacent one end wall of the chamber and free floating in the chamber so that it may move in a direction normal to the wall and rotate in a plane parallel to said end wall, stationary and movable contacts in the chamber, said movable contact being connected with said bar to move

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therewith, a magnet located on the opposite side of said end wall adjacent thereto and mounted to turn in a plane parallel therewith, and means for turning the magnet to cause said bar to turn with it by mutual magnetic action between the bar and magnet to shift the movable contact.

5. An electric switch comprising a body of insulating material enclosing a chamber provided with an end wall, a pair of bars of magnetic material mounted one on each of the opposite sides of said wall to rotate in adjacent planes substantially parallel therewith, one of said bars being a permanent magnet, the inner bar being free floating in the chamber, cooperating stationary and movable contacts in the chamber, the stationary contact being mounted on the opposite wall of the chamber from said end wall, the movable contact being a yieldable spring contact connected with the inner bar to move therewith and riding on the second end wall of the chamber, and means for turning the outer bar to cause the inner bar to turn with it by mutual magnetic action between the bars to shift the movable contact.

6. An electric switch comprising a body of insulating material enclosing a chamber, a free floating bar magnet located in the chamber adjacent one end wall thereof and free to rotate in a plane substantially parallel with said wall, cooperating movable and stationary contacts in the chamber with the movable contact connected with said magnet to move therewith and comprising a yieldable spring contact riding on the opposite end wall of the chamber, the stationary contact being mounted on said latter wall, a second bar magnet located adjacent and on the opposite side of said wall to turn in a plane substantially parallel therewith, and means to turn the second magnet to cause the first magnet to move therewith through mutual magnetic action between the magnets to shift the movable contact.

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