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3,261,944

MAGNETIC SWITCH

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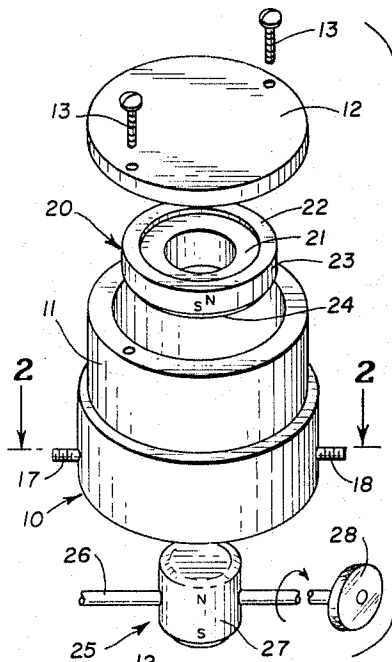


Fig. 1

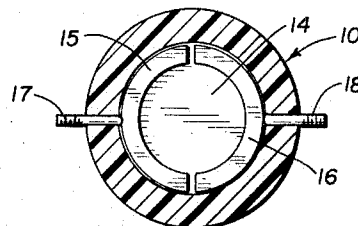


Fig. 2

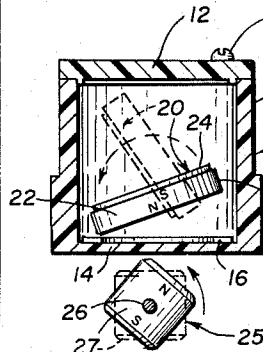


Fig. 3

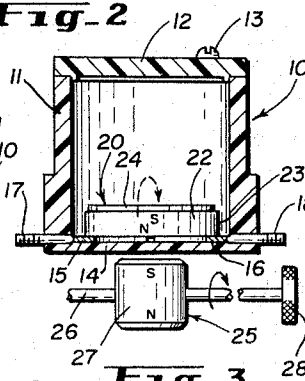


Fig. 4

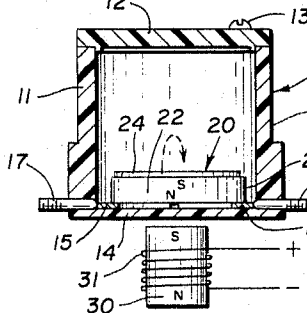


Fig. 5

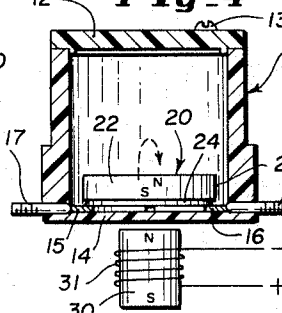


Fig. 6

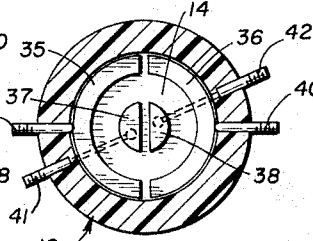


Fig. 7

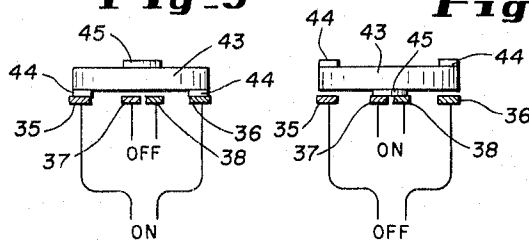


Fig. 8

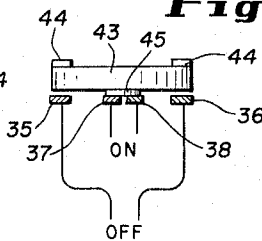


Fig. 9

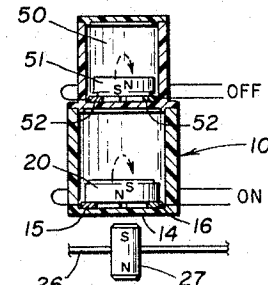


Fig. 10

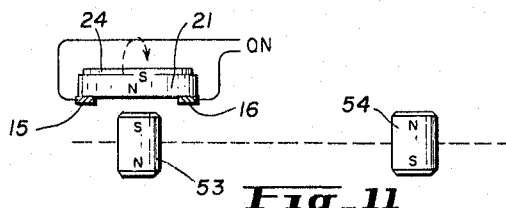


Fig. 11

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MAGNETIC SWITCH

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10 Claims. (Cl. 200-87)

This invention relates to magnetically controlled switches, and more particularly to a switch construction in which a freely movable magnetic contactor and co-operating stationary contacts are enclosed in a housing, and a magnetic control member is located externally of the housing.

The switch housing may be sealed or unsealed, the sealed switch having the advantage that it can be charged with various gases and is explosion-proof and immune to fumes and other adverse factors.

An important object of my invention is to provide a switch construction in which a single moving part serves to open and close one or more electrical circuits.

Another object of the invention is to provide a switch construction which does not require any adjustments to ensure proper contact between the movable and stationary members, and thus eliminates the need for adjustments such as are required when two cooperating contact points are relied upon to open or close an electrical circuit. Further, no adjustment or means other than the movable contactor itself is required to provide good contact between the cooperating contact members.

The movable contact member of my invention is freely bodily movable. It has two major opposite side surfaces. The contactor automatically turns bodily from one side to the other to alternately cause said surfaces to contact the stationary contacts in the housing under influence of the magnetic control member, and thereby to close or open an electrical circuit or circuits.

The freely movable contactor may be made of non-conductive magnetic material or of conductor type magnetic material. If non-conductive material is used, one side is plated or has a conductor attached thereto and the opposite side is an insulator. If a conductor type magnetic material is employed in the movable contact member, one side is insulated and the opposite side serves as the electrical conductor.

Another object of the invention is to construct the freely movable contactor in such form that it is provided with maximum contact surfaces and makes relatively large surface contact with the stationary contacts in the housing. The contacting surfaces are not confined to predetermined areas or fixed points. The contacting engagement between the movable and stationary members varies and takes place over relatively large surface areas of the movable contactor, thus eliminating the wear which results from point to point contact between movable and fixed point contacts.

Another object of the invention is to provide magnetic control means which may consist of a permanent magnet or an electromagnet mounted externally of the switch housing. When the facing poles of the control means outside of the housing and of the movable contactor in the housing are the same, they repel each other and thus cause the movable contactor to turn over from one side to the other. Thus, if the conductor side of the movable contactor is a south pole, it will remain in contact with the stationary contacts in the housing as long as the north pole of the magnetic control faces the movable contactor, and in that position the circuit is closed. When the magnetic control member is rotated and its south pole moved into position facing the south pole of the movable contactor, the movable contactor is repelled thereby and instantly turns over so that its north pole is facing the south pole of the control member, thereby opening the circuit.

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Instead of a permanent magnet, a D.C. coil may be substituted, and if such a coil is used as an electromagnetic control means, the movable contactor will be caused to turn over when the magnetic polarity of the coil is reversed.

Another object is to provide a casing of good insulating material which can be formed to accommodate a freely movable contactor of any desired form. The internal dimensions as to height, width and depth are correlated so that the freely movable contactor will turn over from one major surface to its opposite major surface by a flip-like movement, but cannot go out of the magnetic field of the external magnetic control means. Thus the circuit is opened when the insulator is in contact with the stationary contacts, and closed when the conductor side of the contactor is in contact with the stationary contacts.

In the drawings:

FIG. 1 is an exploded view showing in perspective the switch housing, a cover for the housing, the movable contactor and the externally located magnetic control means of a switch embodying my invention. In this embodiment, the control means is a permanent magnet.

FIG. 2 is a horizontal sectional view in the plane of the line 2-2 of FIG. 1.

FIG. 3 is a vertical sectional view of the switch showing the movable contactor in closed circuit position.

FIG. 4 is a view similar to FIG. 3 showing the movable contactor in the act of turning over from the north pole conductor side to the south pole non-conductive side, and showing the control means in the act of moving to a position in which the north pole is influencing the turning of the movable contactor, at the termination of which steps the circuit will be opened.

FIGS. 5 and 6 are vertical sectional views showing the movable contactor in circuit closing and opening positions respectively, of a switch in which the control means is an electro-magnet.

FIG. 7 is a horizontal sectional view of a modification designed for operating two electrical circuits.

FIGS. 8 and 9 are diagrammatic views showing the movable and stationary contacts of the modification of FIG. 7, in which the movable contactor closes one circuit while the other is open, and then closes the other circuit while the first circuit is opened.

FIG. 10 is a vertical sectional view of another modification of the invention in which an auxiliary switch is placed on top of the main switch, the turning over of the movable contactor in the main switch causing the movable contactor in the auxiliary switch also to be actuated, providing for a wider variation of circuits.

FIG. 11 shows the application of the switch to serve as a limit switch, wherein either the permanent magnet control means or the switch housing travels relatively to the other.

In that embodiment of the invention shown in FIGS. 1-6, inclusive, the switch housing, stationary contacts and freely movable contactor are alike. The housing 10 is cylindrical in cross section, comprising side walls 11, top 12 secured to the side walls by screws 13, and a flat bottom 14 preferably integrally formed with the side walls 11. The housing is made of insulating material. Stationary contacts 15, 16, in the form of flat semi-annular plates, are fastened to the bottom 14 as best shown in FIG. 2. Electrical connectors 17, 18, extend through the side walls 11 into contact with the stationary contact plates 15, 16, in positions diametrically opposite each other.

The freely movable contactor, indicated at 20 as a whole, preferably is disc form, and if made of non-conductor magnetic material as shown, the disc 21 has attached to one of its major side surfaces a conductor

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ring 22 which overlies the outer circumferential surface of one side of the disc and extends partly over and around the peripheral edge 23 of the disc. Thus one major side of the contactor is an insulator 24 and the other side carries the electrical conductor ring 22 which makes contact with the stationary contactors 15, 16, when the movable contactor 20 is facing the fixed contacts 15, 16. If the disc 21 were made of conductor magnetic material, a disc of insulating material would be fixed on one side of the disc and the opposite side of the disc would serve as the conductor.

The magnetic control means located externally of the switch housing 10 is indicated as a whole at 25. It comprises a rotatable shaft 26 on which is fixed a permanent magnet 27. The shaft 26 may be rotated by any suitable means 28.

As shown in FIG. 3, the permanent magnet control member south pole is facing the north pole face of the magnetic disc 21; that is, the movable contactor 21 has its conductor side 22 bearing on the fixed contacts 15, 16, closing the electrical circuit. As soon as the magnetic control member 27 has been turned by rotation of the shaft 26 so that its north pole faces the north pole side of the movable contactor 20, the latter is repelled and instantly makes a combined rising and turning movement shown in FIG. 4, where the insulating side 24 is moving toward the fixed contacts. At the end of the movement, the north pole side on which the conductor 22 is mounted will face upwardly. In this position the contact between the insulator 24 and the fixed contacts 15, 16, opens the circuit.

The switch mechanism shown in FIGS. 5 and 6 is the same as that described, but the magnetic control means located externally of the switch housing 10 comprises an electromagnet 30 in place of the rotated permanent magnet 27. The polarity of the electromagnet 30 is changed by reversing the polarity of the coil 31.

The modification shown in FIGS. 7, 8 and 9 is a two circuit switch mounted in a housing 10 such as hereinabove described. The fixed contacts consist of a circumferentially located pair of semi-annular plates 35, 36, and a pair of centrally located plates 37, 38, fixed on the bottom 14 of the housing. The contact plates 35, 36, are engaged by the connectors 39, 40, and the contact plates 37, 38, are engaged by the connectors 41, 42. In this modification, the movable contactor is shown in FIGS. 8 and 9. It comprises the non-conductor magnetic disc 43 which has a circumferentially located conductor ring 44 on one side for contacting the fixed contact plates 35, 36, and it has a centrally located conductor plate 45 on the opposite side for contacting the contact plates 37, 38.

The two circuit switch functions in the manner heretofore described when either the permanent magnet control means of FIGS. 1-4 or the electromagnetic control means of FIGS. 5, 6, is used. The control means will repel the disc 43 when like poles of the movable disc and control means face each other, causing the disc to turn over from one side to the other, and will attract the disc when unlike poles of the disc and control means face each other. Thus one circuit will be closed by engagement of the movable contact 44 and fixed contacts 35, 36, while the other circuit will be opened as shown in FIG. 8. Upon actuation of the control means, the open circuit will be closed by engagement of the movable contact 45 with fixed contacts 37, 38, while the other circuit will be opened, as shown in FIG. 9.

In FIG. 10, the lower switch member comprises the housing 10, freely movable contactor 20, fixed contacts 15, 16 in the housing 10, and the permanent magnet type control means 27 on rotated shaft 26, heretofore described. An auxiliary housing 50 is mounted on top of the main housing 10, and a movable contactor 51 like the contactor 20 of FIG. 1, with cooperating fixed contacts 52, are located in the housing 50. When the discs

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20 in the lower main housing is caused to turn over, as heretofore described, the magnetic influence of the turning disc 20 also causes the disc 51 in the upper auxiliary housing 50 to turn over. This form of switch construction provides for a wider variation of circuits.

FIG. 11 illustrates a switch of the construction described in connection with FIGS. 1-4, including the freely movable disc 21, fixed contacts 15, 16 and housing 10. In order to serve as a limit switch, two spaced apart control means in the form of permanent magnets 53 and 54 may be used instead of a rotated permanent magnet. If the switch is moved for any purpose, it is actuated by one of the magnets 53 or 54 to open the circuit, and by the other of said magnets to close the circuit when the switch has moved a predetermined distance. If the switch is stationary, the same result will be achieved by moving the spaced apart control magnets 53, 54, into the magnetic field of the switch, so that when one of the two control magnets is adjacent the switch, the circuit will be opened, and when the other control magnet moves into place adjacent the switch the circuit will be closed.

The switch can be adapted for many purposes and uses, all embodiments thereof employing the novel freely movable housing-enclosed magnetic contactor which responds to magnetic control means to turn the contactor disc from one major side surface to the opposite side surface in a flip-like instantaneous motion. The novel result of complete turn-over by the movable disc from one side to the other is achieved by the use of a loose bodily movable magnetic contactor within an insulated housing and of a magnetic control member outside of the housing, the control member having sufficient magnetic property to repel and to attract the movable contactor, alternately, depending on the polar relationship between the said two members.

The internal dimensions of the switch housing as to height and width must be slightly greater than the largest dimension of the movable contactor. In the embodiment shown in FIGS. 1-4, the housing 10 is cylindrical and the movable contactor is a round disc. In that embodiment, for example, the disc measures $1\frac{3}{16}$ inches in diameter and is $\frac{3}{16}$ inch thick. The interior vertical side wall measurement of the housing is $1\frac{3}{8}$ inches, measuring from the upper surface of the fixed contacts to the upper edge of the side wall 11, and the diameter is $1\frac{1}{4}$ inches. Thus the interior of the housing is slightly taller and wider than the diameter of the freely movable contactor, permitting it to turn over from one major side to the other in a movement which momentarily requires the disc side surfaces to be disposed in vertical planes before the side surfaces again are disposed in horizontal planes as shown in the drawings.

It will be understood that reference in the claims to reversing the polarity of the control magnet is intended to comprehend both mechanical rotating of the permanent magnet and reversing of the polarity of the coil in an electromagnetic control member.

Changes may be made in details of construction and form of the parts without departing from the scope of the invention as defined by the appended claims.

I claim:

1. A magnetic switch for electrical circuits comprising
 - (a) a housing made of insulating material,
 - (b) a pair of stationary contact members mounted in the housing,
 - (c) a connector in contact with each stationary contact member connecting the contacts in circuit,
 - (d) a permanently magnetic freely movable contactor engaging said stationary contacts, said movable contactor having opposite side surfaces one of which is an electrical conductor and the other of which is non-conductive,

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- (e) a magnetic control member located outside of the housing, and
- (f) means for reversing the polarity of the control member to repel the movable contactor in the housing and cause the contactor to turn over from one side to the other to alternately open or close the electrical circuit.
2. The magnetic switch defined by claim 1, in which the internal dimensions of the housing are slightly greater in height and width than the largest dimension of the movable contactor.
3. The magnetic switch defined by claim 1, in which the movable contactor is disc shaped, and its diameter is slightly smaller than the diameter and height of the interior of the housing.
4. The magnetic switch defined by claim 1, in which the freely movable contactor is made of magnetic non-conductive material and has an electrical conductor ring fixed on one of its sides, the opposite side serving as an insulator when engaging the stationary contact members to open the circuit.
5. The magnetic switch defined by claim 1, in which the freely movable contactor is made of magnetic conductive material and has insulating means fixed on one of its sides, the opposite side serving as an electrical conductor when engaging the stationary contact members to close the circuit.
6. The magnetic switch defined by claim 1, in which the magnetic control member located outside of the housing comprises a permanent magnet, and means for rotating the magnet for alternately turning the north and south poles to face the movable contactor in the housing.
7. The magnetic switch defined by claim 1, in which the magnetic control member located outside of the housing comprises an electromagnet and coil in which the polarity of the magnet is reversed by reversing the electrical current to the coil.
8. A magnetic switch for a plurality of electrical circuits comprising
- a housing made of insulating material,
 - a plurality of pairs of stationary contact members mounted in the housing, the contacts of each pair being spaced apart and the plurality of pairs of contacts being spaced apart from each other,
 - a connector in contact with each stationary contact member connecting pairs of contacts in a circuit,
 - a permanently magnetic freely movable contactor in the housing having conductor means on each of its opposite side surfaces, one of said conductor means being adapted to rest on a pair of said stationary contact members to close a first circuit,
 - a magnetic control member located outside of the housing, and
 - means for reversing the polarity of the control member to repel the movable contactor in the housing and cause the contactor to turn over from one side to the other and then rest on the stationary

contacts in reversed position to thereby close a second circuit and open said first circuit.

9. A magnetic switch for electrical circuits comprising

- a housing made of insulating material,
- an auxiliary housing of insulating material located on top of the first housing,
- a pair of stationary contact members mounted on the bottom of each of the housings,
- a connector in contact with each stationary contact member connecting the contacts in each housing in a circuit,
- a permanently magnetic freely movable contactor resting on the stationary contacts in each of the two housings, each of said contactors having opposite side surfaces one of which is an electrical conductor and the other of which is non-conductive,
- a magnetic control member located outside of the first housing, and
- means for reversing the polarity of the control member to repel the movable contactor in the first housing and cause the contactor to turn over from one side to the other and thereby cause the movable contactor in the auxiliary housing to turn over from one side to the other, each of said contactors then resting on the stationary contacts in reversed position to thereby either open or close the electrical circuits.

10. A magnetic limit switch for an electrical circuit comprising

- a housing made of insulating material,
- a pair of stationary contact members mounted in the housing,
- a connector in contact with each stationary contact member connecting the contacts in circuit,
- a permanently magnetic freely movable contactor resting on said stationary contacts said movable contactor having opposite side surfaces one of which is an electrical conductor and the other of which is non-conductive,
- a pair of spaced apart magnetic control members located outside of the housing, and
- means for moving one of said the housing and pair of spaced apart control members to place the movable contactor in the housing and one control member into pole facing relationship, and then to place the movable contactor in the housing and the other control member into pole facing relationship.

References Cited by the Examiner

UNITED STATES PATENTS

2,896,043	7/1959	Andrews	200—87
3,040,146	6/1962	Immel et al.	200—87
3,073,919	1/1963	Holder	200—87
3,167,694	1/1965	Bekedam	317—201

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