Aug. 2, 1966 M. BAERMANN 3,264,424

MAGNETICALLY ACTUATED SWITCH

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FIG. 1

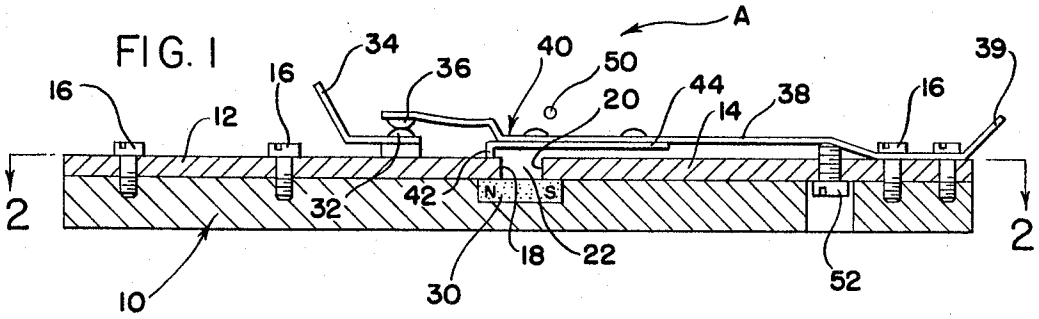


FIG. 2

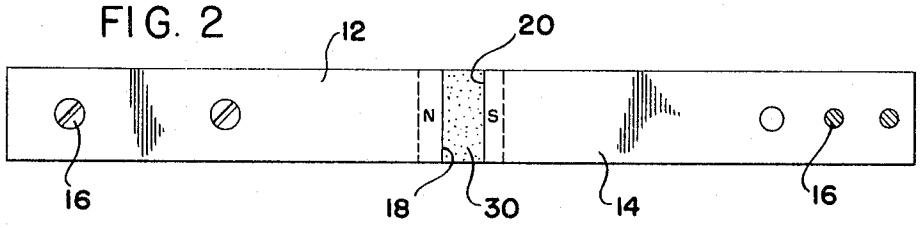
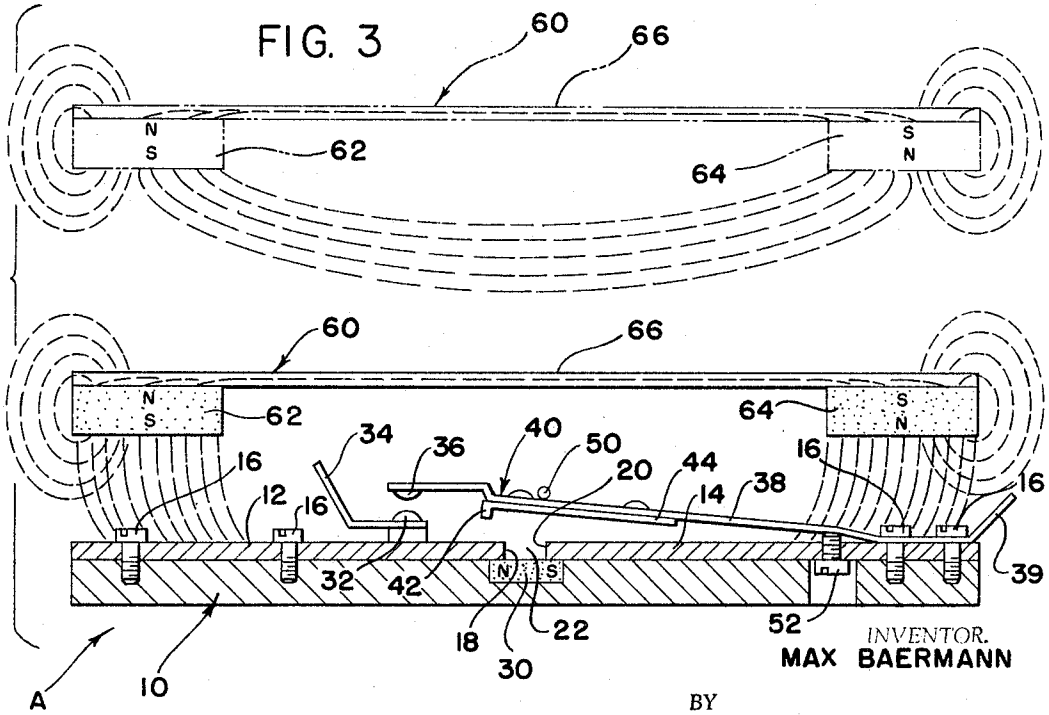


FIG. 3



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FIG. 4

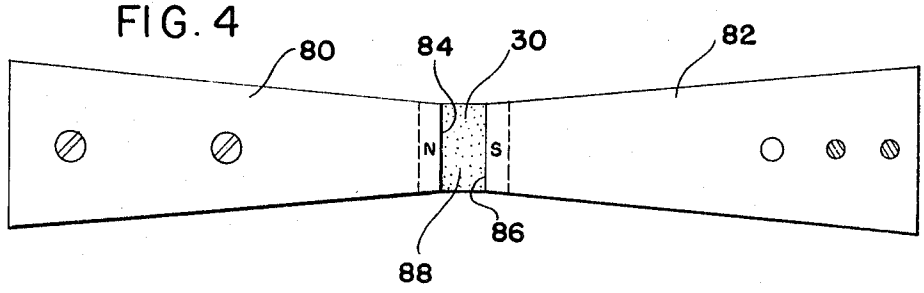


FIG. 5

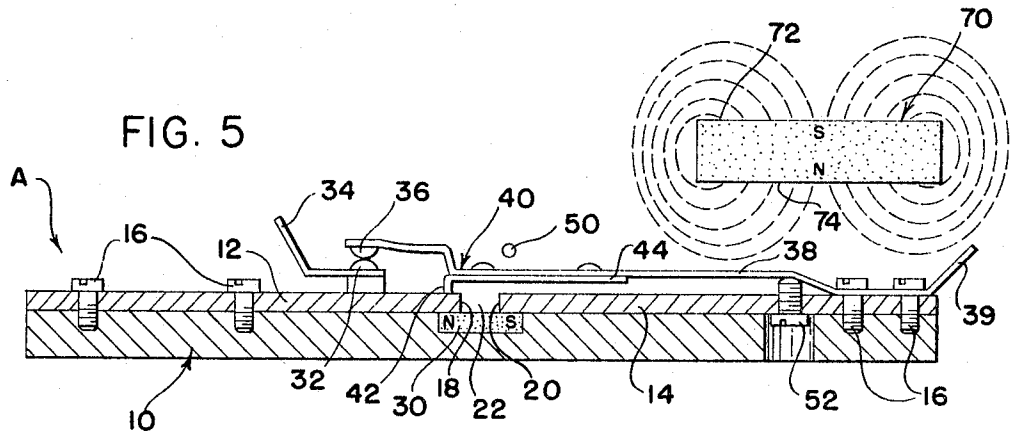


FIG. 6

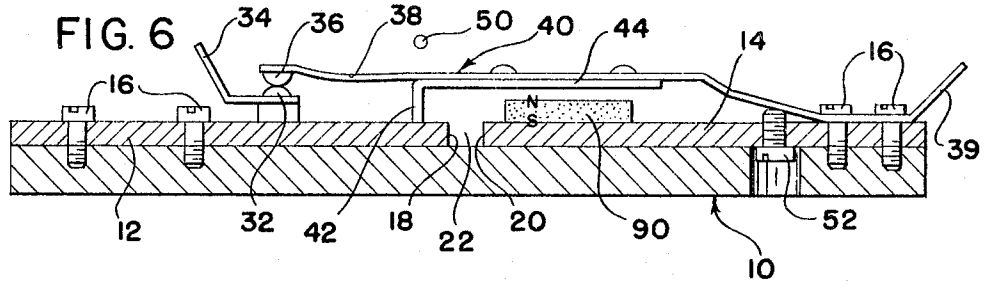
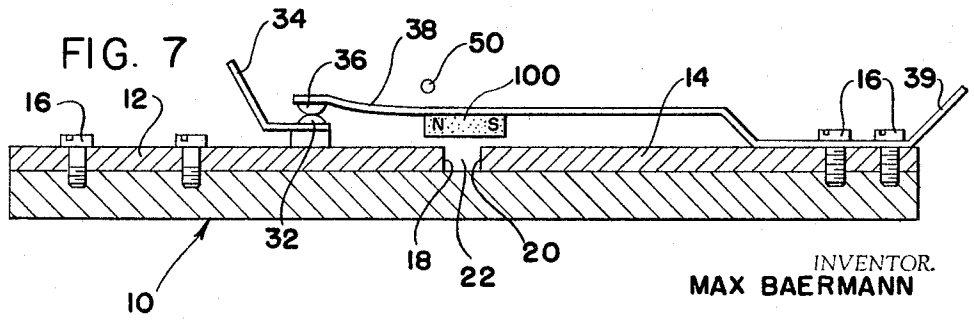


FIG. 7



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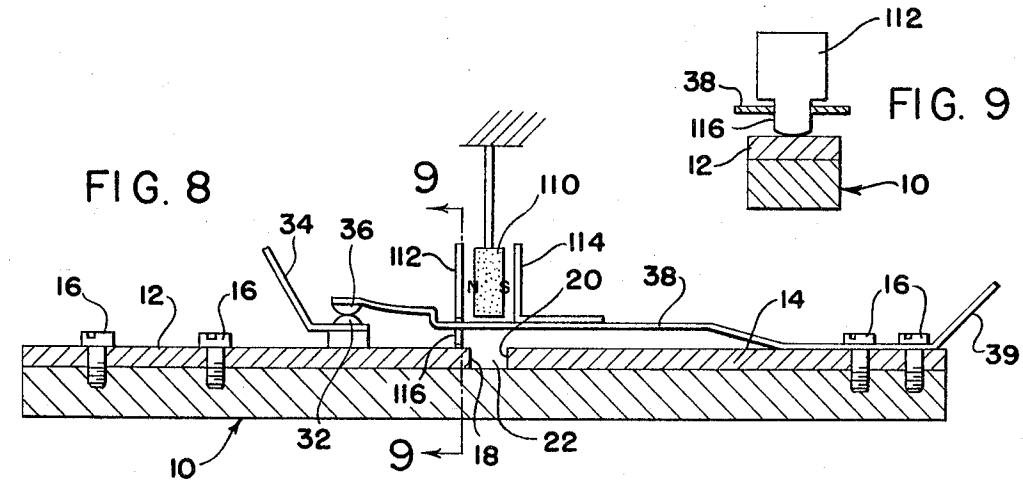
Tilbury & Body

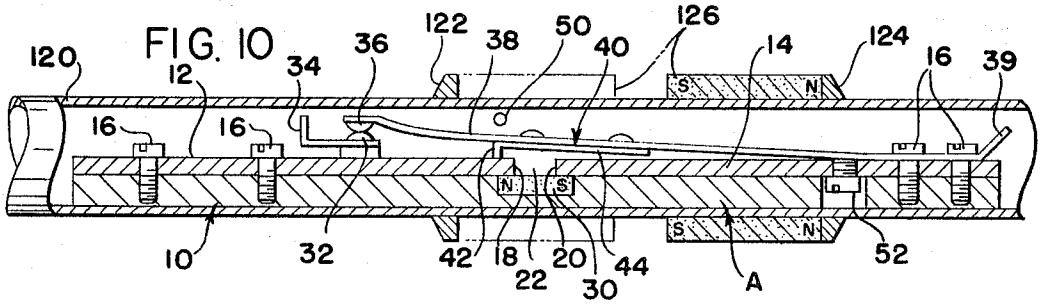
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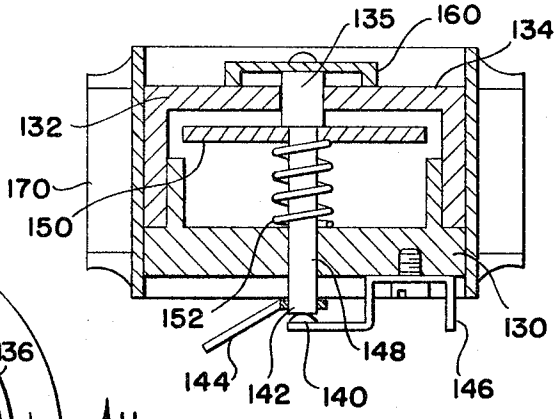
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MAGNETICALLY ACTUATED SWITCH

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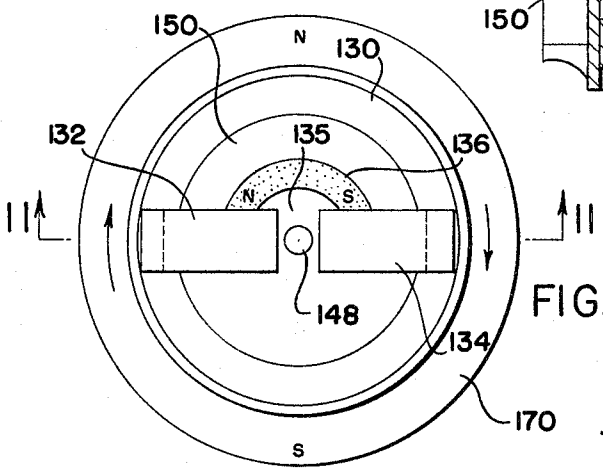


FIG. 12

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3,264,424

MAGNETICALLY ACTUATED SWITCH

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Filed July 23, 1964, Ser. No. 384,585
Claims priority, application Germany, Aug. 2, 1963, B 72,968
11 Claims. (Cl. 200—87)

This invention pertains to the art of electrical switches and more particularly to a magnetically actuated electrical switch.

The invention is particularly applicable to a switch for controlling normally closed contacts, such as the type used for controlling the internal light in a refrigerator cabinet, and it will be described with particular reference thereto; however, it is appreciated that the invention has much broader applications and may be used for controlling normally open electrical contacts, or a combination of both normally open and normally closed contacts.

In the past various types of switching arrangements have been suggested in which electrical contacts are actuated by a permanent magnet. In many instances, the switching arrangement is housed in a closed, nonmagnetic housing with a permanent magnet controlling the contacts through the housing. Such arrangements have taken a variety of structural shapes such as a rotatable permanent magnet which acts upon a similar permanent magnet to operate the contacts within the closed housing. In some cases, ferromagnetic elements within the housing are controlled by an external, movable permanent magnet to cause actuation of contacts within the housing.

All of these known switching arrangements have certain disadvantages. The operating components within the switches have a substantial weight; therefore, there is a tendency for the contacts to be opened or closed when the housing is jarred by an external blow. This gives a false switching of the contacts within the housing, which can often be detrimental to the device being controlled by the switches. Also, these known switching arrangements have a relatively low sensitivity and the actuating mechanism outside of the housing must be very closely spaced with respect to the actuating elements within the housing to accomplish the desired switching function. In most cases, relatively strong and expensive magnets are required to actuate the switching arrangement within the housing. In many of these prior switching arrangements the switching speed depended upon the speed at which the external actuating magnet was moved with respect to the internal operating elements. This prevented rapid making and breaking of the internal contacts and increased the arc erosion of the contacts. In this manner, the effective life of the contacts was substantially decreased.

These and other disadvantages of the prior switching arrangements are completely overcome by the present invention which is directed toward a magnetically controlled electrical switch that is highly sensitive and relatively inexpensive to produce.

In accordance with the present invention, there is provided a magnetically actuated switch comprising a fixed contact, a movable contact, and a biasing mechanism for holding the movable contact in a preselected position. In accordance with the invention the biasing mechanism includes a pair of elongated members extending in generally opposite directions and having ends closely spaced to define an air gap between the elongated members, the elongated members being formed of high permeability material and a permanent magnet with at least a pair of opposite polarity magnetic poles being positioned adjacent the air gap to magnetize the ends of the elongated members and a magnetically permeable element mounted to move with the movable contact and closely spaced from the air gap. In this manner, the magnetized ends of the elongated members attract the magnetically permeable element and hold the movable contact in the preselected position until the elongated members are subjected to an opposing magnetic field. At that time, the movable contact is free to move from the preselected position.

By constructing a switch in accordance with the invention, the spaced elongated members of high permeability material function as magnetic antennas which can concentrate the magnetic lines of force issuing from a permanent magnet field used to actuate the switch. Consequently, even though a relatively small, inexpensive actuating magnet is used, a relatively strong opposing field is created at the air gap between the elongated members.

By increasing the length of the elongated members or antennas the sensitivity of the switch can be increased. It has been found that if the elongated members are increased to a sufficient length, the earth's magnetic field can actually actuate the switch because the elongated, high permeability members concentrate a large number of the magnetic lines of force created by the earth's magnetic field into the small area of the air gap between the elongated members. This concentration of flux lines is sufficient to create an opposing field in the air gap which will cancel out the magnetic field created by the permanent biasing magnet. In this manner, the movable contact shifts from its preselected position under the influence of only the earth's magnetic field. When such a small actuating field is to be used, the elongated members may have a length of several inches to several feet determined by the flux density of the magnetic field which is to be used to actuate the switch. The higher the permeability of these elongated members, the higher the flux concentrating effect; therefore, it has been found that nickel-iron alloys having high permeability are extremely well adapted for construction of these members.

It has been found that a switch constructed in accordance with the present invention is particularly well adapted for various switching applications such as, without limitation, switching house lights, be they wall mounted or lamps, switching cupboard lights when the cupboard door is opened, actuating safety devices in elevators, indicating when a container is filled, and other similar applications. For instance, it has been found that a switch constructed in accordance with the invention can be used to actuate a table lamp by rotating a permanent magnet lying on the table with the lamp going on when the magnet is in one position and the lamp going off when the magnet is in another position. The use of the elongated, high permeability members, or antennas, makes possible this remote operation of the switch positioned within the table lamp.

When the elongated members are relatively long and the sensitivity of the switch has been increased as indicated above, this switch can be used to indicate the approach of a ferromagnetic body, such as a motor vehicle, ship or the like. With long antennas on the switch, the earth's magnetic field can actuate the switch. When the vehicle approaches the switch the earth's magnetic field is concentrated or deflected by the ferromagnetic characteristics of the vehicle so that the earth's magnetic field is no longer strong enough to actuate the switch and the switch will return to its normal condition determined by the biasing permanent magnet. This is a further benefit of a switch constructed in accordance with the present invention which is not found in any prior art switch.

Another application of the present invention is in opening a garage door. If a switch constructed in accordance with the invention is positioned under the approach surface to the garage, the switch can be actuated by an

energized electromagnet on an automobile as the automobile approaches the switch.

A particularly advantageous application of a switch constructed in accordance with the present invention is the use of the switch to control the light within a refrigerator cabinet. Heretofore, a push button extending through the housing of the refrigerator was used to turn the internal light off when the door was closed. This push button can be eliminated by using the present invention. A switch constructed in accordance with the present invention can be secured within the cabinet frame and adjacent the door closing area. An actuating magnet can be carried by the door so that, when the door closes, the actuating magnet is close to the switch within the door. Thus, the switch is operated when the door is closed.

It is appreciated that the incorporation of the magnetic antennas to control the switching of the movable contacts within the switch arrangement allows the switch arrangement to be used in a variety of other environments although they are not herein specifically discussed.

The primary object of the present invention is the provision of a magnetically actuated electric switch which is economical to produce and durable in use.

Another object of the present invention is the provision of a magnetically actuated electric switch which has a high sensitivity and can be operated by relatively small magnetic fields.

Still another object of the present invention is the provision of a magnetically actuated electric switch which includes two spaced magnetic antennas for concentrating an actuating magnetic field to allow operation of the switch by a relatively small external magnetic field.

These and other objects and advantages will become apparent from the following description used to illustrate the preferred embodiments of the invention as read in connection with the accompanying drawings in which:

FIGURE 1 is a cross-sectional, side elevational view showing, somewhat schematically, the preferred embodiment of the present invention;

FIGURE 2 is a cross-sectional view taken generally along line **2—2** of FIGURE 1;

FIGURE 3 is a cross-sectional view somewhat similar to FIGURE 1 showing the operating characteristics of the preferred embodiment as shown in FIGURE 1;

FIGURE 4 is a schematic illustration of a modification of the preferred embodiment as shown in FIGURES 1–3;

FIGURE 5 is a cross-sectional, side elevational view showing another means of actuating the preferred embodiment of the present invention as shown in FIGURES 1–3;

FIGURE 6 is a cross-sectional, side elevational view showing, somewhat schematically, a modification of the preferred embodiment of the present invention;

FIGURE 7 is a cross-sectional, side elevational view showing, somewhat schematically, a further modification of the preferred embodiment of the present invention;

FIGURE 8 is a cross-sectional, side elevational view showing, somewhat schematically, a further embodiment of the present invention;

FIGURE 9 is a cross-sectional view taken generally along line **9—9** of FIGURE 8;

FIGURE 10 is a cross-sectional, side elevational view showing, somewhat schematically, another operating arrangement for the preferred embodiment of the present invention as shown in FIGURES 1–3;

FIGURE 11 is a cross-sectional, view taken generally along line **11—11** of FIGURE 12; and,

FIGURE 12 is a top view showing, somewhat schematically, another modification of the preferred embodiment of the present invention as shown in FIGURES 1–3.

Referring now to the drawings wherein the showings are for the purpose of illustrating preferred embodiments of the invention only and not for the purpose of limiting same, FIGURES 1, 3, 5 and 10 show a magnetically operated switch A including a nonmagnetic base **10** and spaced elongated members or magnetic antennas **12, 14** which are secured onto the base by appropriate means, such as screws **16**. The magnetic antennas are elongated and have facing ends **18, 20** which define therebetween an air gap **22** which is coterminous with a biasing, permanent magnet **30** having a north magnetic pole N adjacent end **18** and a south magnetic pole S adjacent end **20**.

The antennas **12, 14** are formed from a high permeability material, such as without limitation, an iron-nickel alloy so that the permanent magnet **30** magnetizes the ends **18, 20**. The length of antennas **12, 14** may be varied according to the sensitivity desired for switch A and this length can vary from approximately an inch to several inches without departing from the spirit of the invention as hereinafter described in detail.

Switch A also includes a fixed contact **32** electrically connected onto lead **34** and secured onto the base **10** directly beneath a movable contact **36** which is secured onto base **10** by a spring member **38**. The movable contact **36** is electrically connected onto lead **39** so that closing of contacts **32, 36** establishes an electrical circuit between leads **34** and **39**. Directly above air gap **22** there is provided a magnetically permeable armature **40** which, in accordance with the preferred embodiment fo the present invention, is formed from a high permeability material and is laminated in construction. The armature **40** includes a downwardly depending leg **42** directly above end **18** and a body **44** adapted to extend over the end **20**. There is only a slight spacing between the body **44** and the antenna **14**. The spring member **38** forces the contacts **32, 36** together when in the position shown in FIGURE 1 and the amount of upward movement of member **38** is limited by stop **50**. The spring member **38** is stressed to urge armature **40** from the antenna **12**; however, the pull of the magnetized end **18, 20** overcomes the spring force of member **38**. The amount of spring tension of member **38** is adjusted by adjusting screw **52** extending through antenna **14**.

As so far described, the magnetically permeable armature **40** is attracted to the ends **18, 20** by the magnetizing effect of biasing magnet **30**. As the member **38** pivots downwardly upon attraction of armature **40** to the ends **18, 20**, the movable contact **38** touches the contact **32** before the leg **42** contacts end **18** of antenna **12**. Consequently, in the position shown in FIGURE 1, there is a biasing force between the contacts **32, 36**. Also, the member **38** applies an upward springing force on armature **40** which is of a lower magnitude than the attraction force between the armature and the ends **18, 20** so that the armature will move into the position shown in FIGURE 1 against the inherent resiliency of member **38**.

Referring now to FIGURE 3, there is illustrated an actuating magnet assembly **60** including spaced permanent magnets **62, 64** secured onto a body **66** formed from high permeability material. The permanent magnets **62, 64** create a flux field around actuating magnet assembly **60** in a manner somewhat similar to the dashed lines around assembly **60** in the uppermost position of FIGURE 3. In this position, the flux field of the magnet assembly **60** does not affect the condition of the switch A.

As the actuating magnet **60** is moved downwardly in FIGURE 3 toward the switch A, the antennas **12, 14** attract and concentrate the flux field created by spaced permanent magnets **62, 64** so that the flux field between these two magnets primarily extends across the air gap **22**. By proper selection of the polarity of magnets **62, 64** the flux field created by these magnets in air gap **22** is opposite in polarity to the flux field caused by the biasing magnet **30**. When this happens, the two flux fields in the air gap oppose each other and they cancel the effect of each other on armature **40**. At this time, the spring member **38** draws the armature upwardly very rapidly and snaps the movable contact **36** from the fixed contact **32** so that the circuit between leads **34** and **39** is broken. The upward movement of member **38** is controlled or limited by the stop **50** in a manner shown in FIGURE 3.

As the actuating magnet assembly **60** is moved away from the switch A, the flux field created by permanent magnets **62, 64** is no longer concentrated in air gap **22** and the magnetizing effect of magnet **30** again draws armature **40** downwardly into the position shown in FIGURE 1 and the electrical continuity is again established between leads **34** and **39**. Since the antennas **12, 14** are high permeability, the residual magnetism within these antennas is not sufficient to cancel out the magnetizing effect of magnet **30** between operations of the switch.

The antennas **12, 14** focus the flux lines of the actuating magnet assembly **60** in the air gap **22** so that permanent magnets **62, 64** can have a relatively small flux density and still actuate the switch A in a manner described above. If the antennas **12, 14** are increased in length, they become more sensitive and concentrate more flux lines in the air gap. Consequently, if the antennas **12, 14** are extended to a sufficient length they will collect enough flux lines from the earth's magnetic field to actuate the switch into the position shown in FIGURE 3. When this happens, it is possible to reestablish the position of switch A as shown in FIGURE 1 by bringing a ferromagnetic body into close proximity with switch A. This ferromagnetic body will draw the earth's flux lines from the antennas **12, 14** so that the flux density created by the earth's magnetic field in air gap **22** will not be sufficient to overcome the magnetizing effect of biasing magnet **30** and the armature **40** will again be drawn into the position shown in FIGURE 1. This operation of switch A greatly enhances the overall versatility of the switch.

Although the switch A as shown in FIGURES 1–3 utilizes normally closed contacts **32, 36**, it is appreciated that a contact could be positioned above the contact **36** so that it would be closed when the member **38** snaps into the position shown in FIGURE 3. In this manner, the switch A can be conveniently converted into a normally opened type of switch.

Referring now to FIGURE 5, the switch A can be operated by a permanent magnet **70** having an upper surface **72** with a south magnetic pole S and a lower surface **74** with a north magnetic pole N. When this magnet **70** is brought into a position close to the antenna **14**, the flux field created by magnet **70** is concentrated in air gap **22** so that the armature **40** snaps away from the antennas **12, 14** in a manner similar to that discussed in connection with FIGURES 1–3. Since the operation of the switch as shown in FIGURE 5 does not substantially depart from the operation of the switch as shown in FIGURES 1–3, further discussion of this operation is not necessary.

In FIGURE 4, a modification of the antennas **12, 14** is illustrated. In this modification, antennas **80, 82** are truncated in shape with small ends **84, 86** facing each other to define an air gap **88**. The truncated construction of the antennas allows a greater area of antenna to draw the lines of force from an external field; therefore, concentration of the flux lines in the air gap **88** is increased. When the flux density between ends **84, 86** is sufficiently strong to overcome the flux density created by biasing magnet **30**, the switch A, incorporating antennas **80, 82** is operated in a manner discussed in connection with the embodiment shown in FIGURES 1–3.

Referring now to FIGURE 6, a biasing magnet **90** is secured onto antenna **14** with the south magnetic pole S abutting the antenna **14** and the north magnetic pole N facing upwardly toward armature **40**. In this manner, the air gap **22** is in a magnetic circuit including the two antennas **12, 14**, the armature **40**, the magnet **90** and the air space between the magnet **90** and body **44** of armature **40**. Since the air gap is within the magnetic circuit, when an opposing magnetic field is concentrated in the air gap by the antennas **12, 14** the switch as shown in FIGURE 6 will operate in a manner similar to switch A shown in FIGURES 1–3. When the armature **40** is in its downwardmost position, there is very little spacing between the biasing magnet **90** and the armature so that relatively little magnetic losses are caused by the reluctance in this space. The same is true of the spacing between the armature **40** and the antenna **14** in FIGURES 1–3 and 10. The leg **42** in the switch of FIGURE 6 is somewhat longer than the leg **42** in the other embodiments of the invention to accommodate the thickness of biasing magnet **90**.

Another embodiment of the present invention is illustrated in FIGURE 7 wherein biasing magnet **100** is secured onto the spring member **38** so that the magnet **100** performs both the function of the biasing magnet and the function of the magnetically permeable armature **40**. When the contacts **32, 36** are closed, as shown in FIGURE 7, the magnet **100** creates a magnetic circuit including the air gap **22**. Consequently, when the antennas **12, 14** are subjected to an external magnetic field, the opposing magnetic field created within the air gap tends to overcome the magnetic field caused by magnet **100** so that the spring member **38** snaps upwardly to disengage contacts **32, 36**. Basically, the operation of the switch is not substantially different from the operation of switch A as shown in FIGURES 1–3 and 10.

Another embodiment of the present invention is shown in FIGURE 8 wherein a permanent biasing magnet **110** is fixedly positioned above the switch and the armature **40** is replaced by two pole pieces **112, 114** with the pole pieces being closely spaced with respect to the magnetic poles of magnet **110**. The pole piece **112** has a downwardly extending leg **116** which performs the function of leg **42** in the previously described embodiments of the invention. The magnet **110** creates a flux circuit through the pole pieces and across the air gap **22**. The pole pieces are formed of high permeability material so that the pole pieces are attracted to the antennas **12, 14** in a manner similar to the attraction of armature **40** to the antennas **12, 14**. Again, an opposing field will be concentrated by the antennas **12, 14** in the air gap **22** so that this opposing field can overcome the field created by magnet **110** and allow the spring member **38** to snap the contacts **32, 36** from engagement.

In FIGURE 10, there is illustrated an arrangement for actuating switch A of the type disclosed in FIGURES 1–3. In this figure, a nonmagnetic tube **110** which may be the stem or post of an electric lamp, is provided with stops **122, 124** and an annular magnet **126**, which is axially magnetized, is adapted to move between these stops. When the magnet **126** is in the position shown by the solid lines in FIGURE 10, the magnet does not create a circuit through air gap **22**; and, the switch A is in the position shown in FIGURES 1 and 10. When the magnet **126** is moved to the left, in FIGURE 10, into engagement with stop **122**, the magnet then creates an opposing magnetic field within the air gap **22** so that the contact **36** is snapped away from the contact **32** in the manner previously described. Consequently, this arrangement provides a convenient remote control for the actuation of switch A.

Referring now to FIGURES 11 and 12, a further embodiment of the present invention is illustrated. A nonmagnetic, cup-shaped body **130** is adapted to support L-shaped antennas **132, 134** that define an air gap **135**. Between the ends of the antennas **132, 134** there is provided an arcuately shaped permanent biasing magnet **136** having a north magnetic pole N and a south magnetic pole S in contact with the ends of the antennas. A fixed contact **140** is secured onto body **130** and a movable contact **142** is adapted to selectively engage the fixed contact. In this manner, an electrical circuit is made and broken between leads **144, 146**. The movable contact **142** is carried by a plunger **148** having at its upper end a plate **150** which forms a stop for compression spring **152** so that the plunger **148** is biased upwardly by the spring. At the upper end of plunger **148** there is provided a high permeability

magnet armature **160** which is attracted to the antennas **132, 134** by the flux field created by magnet **136**. Surrounding the body **130** is an annular magnet **170** which is diametrically magnetized to provide a north magnetic pole N on one side and a south magnetic pole S on the opposite side. When the magnet **170** is rotated so that the poles face the antennas **132, 134**, the magnet **170** creates an opposing field within the air gap **135** and the armature **160** is released from the antennas **132, 134** so that the spring **152** can move the plunger **148** in an upward direction. This breaks the contact between contacts **140, 142** and opens the circuit between leads **144, 146**. When the magnet **170** is rotated 90° with respect to the antennas **132, 134**, the armature is again attracted to the antennas and the contacts **140, 142** are closed.

A variety of magnetic materials could be utilized for the actuating and/or biasing magnets as described herein; however, in accordance with the preferred embodiment of the present invention, these magnets are formed from particles of barium ferrite, strontium ferrite, lead ferrite, or bismuth-manganese embedded within and bonded together by a plastic or rubber binder.

The biasing magnets which are used to create a magnetic circuit including the air gap **22** may be rotated or otherwise shifted to change the amount of biasing flux within the air gap **22**. In this manner, the amount of flux necessary for operating the switch can be conveniently varied. In addition, it is appreciated that the switch can be enclosed within a non-magnetic housing so that contaminating materials can be excluded from the operating elements of the switch. When such a housing is used, a protective gas can be sealed within the housing to further protect the operating elements of the switch. All of these features are within the contemplation of the invention.

The present invention has been described in connection with several embodiments and it is to be appreciated that various structural changes may be made in these embodiments without departing from the intended spirit and scope of the present invention as defined in the appended claims.

Having thus described my invention, I claim:

1. A magnetically actuated switch comprising a fixed contact, a movable contact, a biasing mechanism for holding said movable contact in a preselected position with respect to said fixed contact, and means for urging said movable contact from said preselected position, the urging effect of said means being less than the biasing effect of said biasing mechanism, said biasing mechanism including a pair of flat, elongated antenna members mounted in generally the same plane and extending in generally opposite directions and having ends closely spaced to define an air gap between said elongated members, said elongated members being formed of high permeability material, and a permanent magnet with at least a pair of opposite polarity magnetic poles being positioned adjacent said air gap to magnetize said ends with opposite magnetic poles and a magnetically permeable element mounted to move with said movable contact and being closely spaced from said air gap whereby said magnetized ends of said elongated members attract said element and hold said movable contact in said preselected position until said elongated members are subjected to an opposing magnetic field at which time said urging means move said movable contact and element from said preselected position.

2. A switch as defined in claim **1** wherein said urging means is a spring member and said movable contact and permeable element are mounted on said spring member, said biasing mechanism flexing said spring member when said movable contact is in the preselected position so that said spring member can move said movable contact from said preselected position when said elongated members are subject to said opposing magnetic field.

3. A switch as defined in claim **2** wherein said preselected position is when said movable contact is in electrical contact with said fixed contact and said flexing of said spring member biases said contacts together with a force less than the attraction force exerted on said magnetically permeable element.

4. A switch as defined in claim **1** wherein said permanent magnet is fixedly located with respect to the ends of said elongated members and is coterminous with said air gap and said magnet has one magnetic pole against one of said ends and an opposite polarity pole against the other of said ends.

5. A switch as defined in claim **1** wherein said permanent magnet is fixedly located on one of said elongated members with one of said magnetic poles in contact with said elongated member and the other of said magnetic poles spaced from said elongated member and facing said magnetically permeable element.

6. A switch as defined in claim **1** wherein said movable contact is carried by a movable element and said permanent magnet is attached to said movable element with one magnetic pole facing one of said ends and the other magnetic pole facing the other of said ends.

7. A switch as defined in claim **1** wherein said movable contact is carried by a movable member, said magnetically permeable element having first and second pole pieces, said permanent magnet being located between said pole pieces with one of said magnetic poles facing each of said pole pieces and premagnetizing said ends through said pole pieces.

8. A magnetically actuated switch comprising a fixed contact, a movable contact, a biasing mechanism for holding said movable contact in a preselected position with respect to said fixed contact, and means for urging said movable contact from said preselected position, the urging effect of said means being less than the biasing effect of said biasing mechanism, said biasing mechanism including a pair of elongated members extending in generally opposite directions and having ends closely spaced to define an air gap between said elongated members, said elongated members being formed of high permeability material, and a permanent magnet with at least a pair of opposite polarity magnetic poles being positioned adjacent said air gap to magnetize said ends with opposite magnetic poles and a magnetically permeable element mounted to move with said movable contact and being closely spaced from said air gap whereby said magnetized ends of said elongated members attract said element and hold said movable contact in said preselected position until said elongated members are subjected to an opposing magnetic field at which time said urging means move said movable contact and element from said preselected position, a nonmagnetic, tubular housing surrounding said switch and an annular, actuating magnet slidably received on said housing, said magnet being axially magnetized with one magnet pole adjacent each end thereof, said magnet being slidable between a first position remote of said air gap and a second position adjacent said air gap in which second position the biasing action of said biasing mechanism is overcome by said actuating magnet.

9. A magnetically actuated switch comprising a fixed contact, a movable contact, a biasing mechanism for holding said movable contact in a preselected position with respect to said fixed contact, and means for urging said movable contact from said preselected position, the urging effect of said means being less than the biasing effect of said biasing mechanism, said biasing mechanism including a pair of elongated members extending in generally opposite directions and having ends closely spaced to define an air gap between said elongated members, said elongated members being formed of high permeability material, and a permanent magnet with at least a pair of opposite polarity magnetic poles being positioned adjacent said air gap to magnetize said ends with opposite magnetic poles and a magnetically permeable element mounted to move with said movable contact and being closely spaced from said air gap whereby said magnetized

ends of said elongated members attract said element and hold said movable contact in said preselected position until said elongated members are subjected to an opposing magnetic field at which time said urging means move said movable contact and element from said preselected position, an annular actuating magnet surrounding said switch and having a pair of diametrically spaced magnetic poles and means for rotating said actuating magnet into a position with the poles adjacent said elongated members to overcome the biasing action of said biasing mechanism.

10. A magnetically actuated switch comprising a fixed contact, a movable contact mounted on a movable member and adapted to be selectively moved into and out of engagement with said fixed contact as said movable member is moved, a pair of flat, elongated antenna members mounted in generally the same plane and extending in generally opposite directions and having ends closely spaced to define an air gap between said elongated members, said elongated members being formed of high permeability material, a permanent magnet with at least a pair of opposite polarity magnetic poles being positioned adjacent said air gap to magnetize said ends of said elongated members, and a magnetically permeable element mounted on said movable member and closely spaced from said air gap whereby said magnetized ends of said elongated members attract said element until said elongated members are subjected to an opposing magnetic field.

11. A magnetically actuated switch comprising a fixed contact, a movable member with a magnetically permeable element, a movable contact secured onto said movable member and adapted to selectively contact said fixed contact, a pair of elongated members extending in opposite directions and having ends closely spaced to define an air gap between said elongated members, said elongated members being formed of high permeability material, said magnetically permeable elements being closely spaced from said air gap, a permanent magnet adjacent said air gap to magnetize said ends, an annular actuating magnet surrounding said elongated members and radially magnetized to have diametrically spaced magnetic poles, means for rotatably mounting said actuating magnet to selectively bring said pole into magnetic proximity to said elongated members to oppose the magnetization of said ends and spring means for biasing said movable member away from said pole ends, said biasing effect of said spring means being less than the magnetic pull of said magnetized ends.

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