

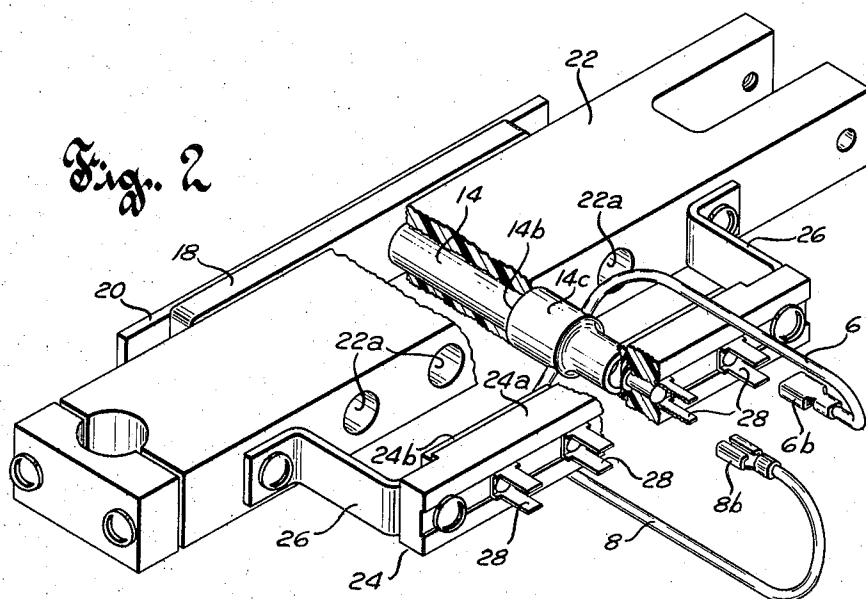
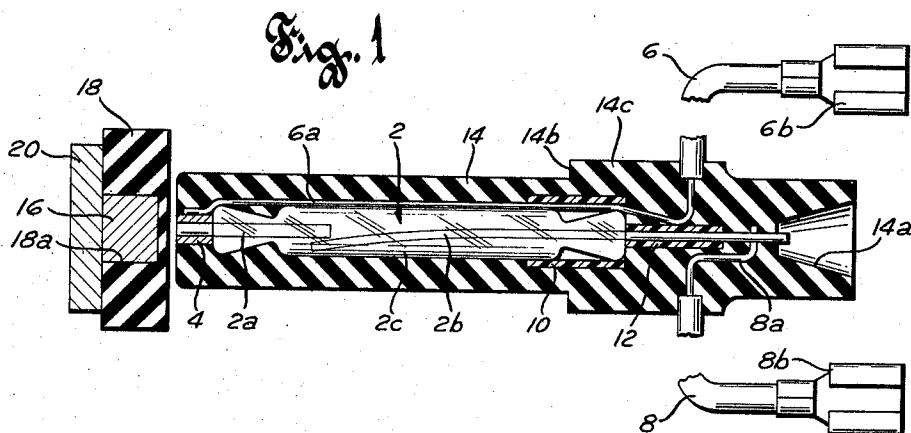
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MAGNETICALLY OPERABLE SWITCHING DEVICE

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MAGNETICALLY OPERABLE SWITCHING DEVICE

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This invention relates to magnetically operable switching devices and more particularly to switching devices of the enclosed reed type wherein the circuit controlling contacts are actuated by an external magnetic field.

While not limited thereto, the invention is especially applicable to code reader devices for extracting control information from magnetic memory devices such as is disclosed in DeWitt et al. copending application Serial No. 258,185 filed February 13, 1963, or the like.

An object of the invention is to provide an improved magnetically operable switching device.

A more specific object of the invention is to provide an improved reed switch.

Another specific object of the invention is to provide an elongated reed switch of the type having an enclosing envelope with improved means for sensitizing an end of such switch to enable actuation of the contacts therein by passage of a small magnetized element past such end.

Another specific object of the invention is to provide such elongated reed switch with improved means forming a probe type switch having a forward end sensitive to magnetic fields and a rear end from which connecting conductors extend.

Another object of the invention is to provide such elongated reed switch with improved means facilitating ready insertion thereof into a hole through a mounting block whereby the inserted end is left exposed for access to magnetic fields.

Other objects and advantages of the invention will hereinafter appear.

According to the invention, there is provided a short tubular slug of magnetizable electrically conducting material around one external end terminal, preferably the terminal of the shorter stationary contact, of an enclosed reed switch and immediately adjacent the end of the reed switch envelope. This slug may be welded to such end terminal to form a good magnetic path therebetween. This slug may be in close proximity to such end terminal but the magnetic effect is enhanced when such slug is in physical contact with the end terminal. An end of a first conductor is electrically connected to this end terminal preferably through this slug and extends along the envelope past the other end of the switch. An end of another conductor is electrically connected to the other external end terminal of the reed switch. The other ends of the two conductors are provided with electrical connectors whereby the reed switch may be connected to an external circuit. This subassembly is then embedded in a molded case to provide a probe type of reed switch. That is, the molded case has a reduced cylindrical configuration from its forward, sensing end throughout most of its length to afford insertion into a round hole through a mounting block. At the rear end of the reed switch envelope, the molded case is provided with a portion having an enlarged cylindrical configuration to provide support for the conductors emerging therefrom radially in opposite directions and to provide a shoulder which bears against the mounting block when the reduced forward end portion is inserted in a hole therein. The extreme rear end portion of the molded case may also have such reduced cylindrical configuration whereby the molded reed switch is clamped into its mounting block. In this manner, the reed switch is completely enclosed in the molded case except the forward ends of its mag-

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netizable slug and terminal which are left exposed for sensing magnetic fields. A series of molded encased reed switches of this type are adapted for insertion in spaced holes through a mounting block and the rear ends thereof may be clamped by a terminal strip secured by brackets to the mounting block. The conductors of the reed switches are connected to electrical connectors on the terminal strip which may also be connected to an external circuit. The switches are actuated by passing small magnetized elements past the slugs at the forward ends thereof and the switches may be operated in selected or coded combinations depending on which elements are magnetized.

These and other objects and advantages of the invention and the manner of obtaining them will best be understood by reference to the following detailed description of an embodiment thereof taken in conjunction with the accompanying drawing, wherein:

FIGURE 1 is a cross-sectional view of a molded reed switch and a magnetic operating element constructed in accordance with the invention; and

FIG. 2 is an isometric view of the apparatus of FIG. 1 and its mounting means partly broken away to show the exterior of the molded reed switch.

Referring to FIG. 1, there is shown an enclosed reed switch 2 which may be of a known type having a stationary contact 2a and a movable contact 2b enclosed and hermetically sealed in an elongated tubular envelope 2c. The envelope is preferably comprised of transparent material such as glass and the opposite ends thereof are sealed around the stationary and movable contacts to support the latter so that the inner ends of the contacts overlap and are spaced from one another providing a normally open switch. The contacts extend through the opposite ends of the envelope to provide external terminals. In reed switches of this type, the movable contact is longer than and extends a greater distance within the envelope than the stationary contact to provide resiliency so that a magnetic field can bend the same into engagement with the stationary contact.

The reed switch is provided with means for sensitizing the same to enable operation of the contacts by small magnetic elements passing by one end of the switch. This means comprises a short tubular slug 4 comprised of electrically conducting and magnetizable material such as steel for concentrating the operating magnetic field in the switch terminal and contact. As the stationary contact is shorter and thicker than the movable contact, the stationary contact end is selected for use as the sensing end of the switch. As shown in FIG. 1, slug 4 is slid onto and around the external terminal of stationary contact 2a in close proximity to or against the end of the glass envelope and is rigidly secured thereto as by tack welding to hold the parts together. The frictional fit of the slug on the terminal forms an electrical and magnetic connection therebetween. The terminal is cut off flush with the forward end of the slug.

The reed switch is provided with short electrical conductors to enable connection thereof through a terminal strip to an external electrical circuit. These conductors include a first conductor 6 connected to stationary contact 2a and a second conductor 8 connected to movable contact 2b. As shown in FIG. 1, conductor 6 is provided with a bare wire portion 6a the end portion of which is electrically connected as by welding to the outer surface of slug 4 and therethrough and through the terminal to the movable contact so that the end of the bare wire does not extend beyond the forward end of the slug. It will be apparent that the end portion of bare wire portion 6a could alternatively be connected directly to the external terminal of stationary contact 2a. The bare wire portion extends along the exterior of envelope 2c to a point adja-

cent the terminal of the movable contact and at this point is bent to extend radially from the switch. The remainder of conductor 6 is insulated and the other end is provided with an electrical connector such as receptacle 6b for receiving a tongue connector. An insulating sleeve 10 is slid over envelope 2c and bare conductor 6a to the rear end of the envelope to hold the bare conductor to the envelope. Another insulating sleeve 12 is slid over the terminal of movable contact 2b up to envelope 2c to insulate bare conductor 6a therefrom. Conductor 8 is provided with a short bare wire portion 8a the end of which is secured to the terminal of the movable contact at a point rearwardly of sleeve 12 and electrically connected thereto as by welding. Bare wire portion 8a is bent forwardly to partially overlap the rear end of sleeve 12 and is then bent outwardly or radially to extend in a direction opposite to that of the insulated portion of conductor 6. The remainder of conductor 8 is insulated and the other end is provided with an electrical connector such as receptacle 8b similar to receptacle 6b.

The subassembly hereinbefore described is provided with a molded case 14 for strengthening the same and to form a probe-like switch. That is, plastic electrically insulating material is cast or molded around this subassembly completely to enclose the same except that the forward ends of slug 4 and the terminal of the stationary contact are left exposed. Although the extreme rear tip of the movable contact terminal is shown exposed in FIG. 1 at the bottom of a frusto-conical depression 14a in the rear end of the molded case, this is not required for functional purposes but instead results from the molding process. This tip is gripped in the mold and the subassembly is held thereby and centered when the molding material is applied. The forward end of molded case 14 is provided with a reduced diameter, cylindrical shape to a point near the rear end of envelope 2c where such reduced portion ends in a shoulder 14b. Rearwardly of this shoulder, the molded case is provided with a larger diameter, cylindrical shaped portion 14c to provide support for conductors 6 and 8. As shown in FIG. 1, the insulated portions of the conductors are partially embedded in such enlarged portion of the molded case. The extreme rear end portion of the molded case is preferably also of reduced diameter.

FIG. 1 also illustrates a magnetic operator for the switch hereinbefore described. This operator comprises a small cylinder 16 of magnetizable material such as Alnico V alloy hereinafter referred to as a magnetizable element. Element 16 is snugly fitted in a complementary cavity 18a in a non-magnetic base 18 and is retained therein by a supporting member 20 covering the opening to such cavity. Base 18 is preferably rigidly secured to supporting strip 20 as by rivets. As shown in FIG. 1, cavity 18a extends almost through base 18 so that only a thin portion of insulating material remains between element 16 and the forward sensing end of the switch.

As shown in FIG. 2, base 18 is an elongated member so that it can accommodate a plurality of magnetizable elements 16 spaced therealong in a row. Also, supporting member 20 is shown as an elongated plate or strip the ends of which extend beyond the ends of base 18 whereby it can be secured to a moving mechanism. Strip 20 may be comprised of magnetizable steel or the like, whereby it acts as a magnetic path and allows use of a smaller magnetizable element 16.

FIG. 2 additionally shows mounting and connecting means for a plurality of switches. This mounting means comprises an elongated block 22 of electrically insulating material, a clamping member 24 and a pair of substantially Z-shaped brackets 26 for securing the clamping member to the block. The aforementioned connecting means comprises a plurality of electrical connector terminals 28 secured to clamping member 24 which together may constitute a terminal strip.

Block 22 is provided with a plurality of round holes 22a therethrough for receiving a plurality of switches so that shoulder 14b bears against the front surface of the block. The ends of the block are provided with suitable securing structures adapting the block for mounting and stepless adjustment on a pair of spaced vertical rods.

Clamping member 24 may take the form of a terminal strip comprising a bar 24a of insulating material having a hole at each end for securing the same to first ends of brackets 26 by screws or the like whereas the other ends of the brackets are secured to the front surface of block 22 by screws to clamp the switches in their holes 22a. Between the end screws bar 24a has secured to the front surface thereof a series of terminals 28 by rivets or the like. Each terminal 28 is illustrated as having a U-shape providing a pair of connector tongues and having a hole in the yoke portion between the tongues whereby the terminal is riveted to strip 24a. Connector receptacles 6b and 8b may be placed on first tongues of a pair of terminals and the other tongues thereof may be connected to an external circuit. A strip 24b of resilient material such as rubber is secured as by cementing to the rear surface of strip 24a to bear against the rear ends of the switches to avoid the requirement for close tolerances in these parts.

When a magnetized element 16 is moved past the forward sensing end of the switch, the magnetic field emanating from such element is concentrated or drawn by slug 4 into the end of the switch. That is, use of slug 4 provides a low reluctance path of larger cross-sectional area for the magnetic flux whereby the latter is concentrated in the end of the switch. As a result, the stationary contact becomes magnetized and attracts the movable contact thereto to close the contacts as shown in FIG. 1. Use of slug 4 reduces the magnetic field strength required to be emitted by element 16 for reliable operation of the switch. When element 16 is moved away from the sensing end of the switch, the magnetism retained in the stationary contact is insufficient to overcome the mechanical spring bias of the movable contact and the movable contact separates from the stationary contact.

As shown in FIG. 2, a row of magnetizable elements 16 are passed by a row of switches. These elements may be magnetized in selected combinations or codes to operate only some of the switches. Such arrangement of switches and magnetic operators would have numerous applications.

While the invention hereinbefore described is effectively adapted to fulfill the objects stated, it is to be understood that we do not intend to confine our invention to the particular preferred embodiment of magnetically operable switching device disclosed, inasmuch as it might be susceptible of various modifications without departing from the scope of the appended claims.

We claim:

1. In combination with a commercially available reed switch having an elongated tubular sealed envelope and a pair of magnetizable switch contacts extending from overlapping relation within the envelope through opposite sealed ends thereof to form external electrical terminals and adapted to be operated by an external magnetic field producing element moving past one end thereof, the improvement comprising:

(a) means sensitizing one end of said switch to the external magnetic field comprising a slug of magnetizable material in close proximity to an external terminal for concentrating the magnetic field in the associated contact thereby adapting it for operation by a reduced magnetic field at said one end;

(b) and a pair of conductors connected to the opposite end terminals for connecting the switch contacts to an external circuit.

2. The invention defined in claim 1, together with:

(a) a molded case surrounding said reed switch and slug and portions of said conductors.

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3. The invention defined in claim 2, wherein:
- (a) the conductor connected to the sensitive end extends along the exterior of the envelope and both conductors emerge from the molded case near the other end thereof; 5
 - (b) and the exterior portions of the conductors are insulated and are provided with electrical connectors at their ends for connection to an external circuit.
4. The invention defined in claim 2, wherein:
- (a) a portion of said magnetizable slug is exposed to the atmosphere from said molded case adapting it for passage of a magnetic field producing element very close thereto. 10
5. The invention defined in claim 3, wherein:
- (a) said molded case is provided with a reduced forward end portion extending from the sensitive end thereof adapting it for mounting and a relatively enlarged rear portion to provide support for the emerging conductors. 15
6. The invention defined in claim 1, wherein:
- (a) said magnetizable slug has a short tubular form and snugly surrounds the associated terminal adjacent the end of the envelope; 20
 - (b) and said terminal within said slug is cut off flush with the end of the latter. 25
7. The invention defined in claim 1, wherein:
- (a) one of said contacts is shorter than the other contact and said slug is connected to the terminal of such shorter contact.
8. In a magnetically operable switching device having an elongated tubular sealed envelope and a pair of magnetizable switch contacts extending from overlapping spaced relation within the envelope through opposite sealed ends thereof to form external electrical terminals and adapted to be operated by an external magnetic field producing element moving past one end thereof, the improvement comprising: 35
- (a) means sensitizing one end of said switching device to an external magnetic field comprising a short tubular slug of magnetizable and electrically conducting material snugly surrounding one end terminal for concentrating the magnetic field in the associated contact thereby adapting it for operation by a reduced magnetic field to close the switch contacts; 40
 - (b) a first electrical conductor connected to said slug and extending along the exterior of the envelope to the other end of the latter; 45
 - (c) a second electrical conductor connected to the other end terminal;

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- (d) and a molded case surrounding said switching device and slug and portions of said conductors and said case having a reduced cylindrical portion extending rearwardly from the sensitive end and a relatively enlarged portion at the rear end forming a shoulder therebetween adapting it for mounting and said enlarged portion providing support for the conductors emerging therefrom.
9. The invention defined in claim 8, wherein:
- (a) said cylindrical slug and the terminal therewithin are flush with the forward end surface of the molded case and are exposed to the atmosphere adapting it for passage of a magnetized operating element adjacent thereto.
10. The invention defined in claim 9, together with:
- (a) a mounting block having a plurality of holes there-through for receiving the reduced end portions of a plurality of switching devices;
 - (b) a pair of brackets secured in spaced apart relation to the side of the block from which the switches are inserted;
 - (c) and a clamping bar secured to said brackets for engaging the rear ends of the switches to clamp them into their holes.
11. The invention defined in claim 10, wherein:
- (a) said clamping bar comprises a terminal strip serving the dual function of clamping the switches in their mounting holes and providing terminals whereby the conductors of the switches are connected to an external circuit.
12. The invention defined in claim 11, wherein:
- (a) said terminal strip comprises a strip of resilient material on the surface thereof which engages the rear ends of the switches.

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