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LATCHING REED RELAY

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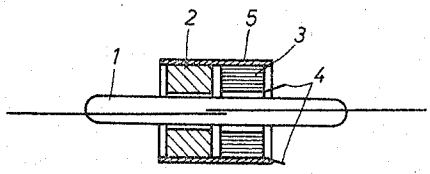

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LATCHING REED RELAY

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ABSTRACT OF THE DISCLOSURE

Latching reed relays utilizing permanent magnets and control coils wound of magnetizable material, such as magnetizable tape strips.

The invention relates in general to relays and in particular to adhesive or latching relays with reed contacts. The latching relay is brought from one operative position into another operative position by a current surge, remaining there, after the exciting current has been switched off, until it is returned to the original position by an oppositely directed current surge.

In the telecommunication field, relays are used having contacts which serve as armatures. One or several reed tubes containing the contacts are surrounded by an excitation coil which produces a magnetic flux to control the armature contacts. Permanent magnets may also be used to control the contacts. The permanent magnet may be formed either as a rod-type magnet or as a ring-shaped magnet which is shifted in the axial direction of the reed tubes to control the contacts. To close the contacts the permanent magnets are moved so that the flux in the operating air gap between the contacts is reinforced, while the magnets are moved so that the flux is reduced when it is desired to open the contacts.

It is frequently desirable to equip such a relay with latching properties. To this end a permanent magnet is provided in the known constructions, in addition to the exciting coil, which permanent magnet is magnetized in parallel to the contacts. The permanent magnet is designed to provide a magnetomotive force that is not sufficient to close or open armature contacts but is sufficient to maintain a closed condition in contacts closed after having been excited by the coil. The armature contacts are opened through a magnetic flux produced by the exciting coil in the opposite direction. Such latching relays known to the art show the advantage that in the time during which the armature contact is closed no current needs to flow through the exciting coil. Moreover, if the permanent magnet is suitably poled relative to the magnetic flux of the exciting coil the responding and dropping excitation is influenced in said direction and in the same magntude. That means the ratio of response excitation and dropping excitation becomes smaller than with relays having no latching effect.

The latching relays of this type, known to the art, which have a copper winding arranged either beside or above the permanent magnet, however, show some substantial disadvantages. The magnetomotive force of the permanent magnet must be dimensioned so that it does not close the armature contact, if the coil is not excited, but keeps said armature contact in the closed condition safely, after the excitation by coil has ceased. This involves vigorous design of the permanent magnet. The design requirements are further aggravated by the heavy tolerance fluctuations that occur during the fully automatic production of reed contacts with regard to the contact spaces of the individual armature contacts and the elasticity of the contact blades. Another disadvantage of the constructions known is the use of a copper winding as exciting coil. Besides that a copper winding represents a considerable factor within the overall costs of such a relay, said winding must be excited through a current surge, lasting for one millisecond, in order to establish a magnetic flux for switching the armature contacts. As it is necessary to control those adhesive relays known to the art with "long" pulses, they are unsuitable for application in electronic systems, operating with essentially shorter pulses (approximately thousand times).

It is the object of the invention to avoid the disadvantages of the adhesive relays known and to provide an adhesive relay with reed contacts, constructed in the simplest way, the exciting coil of which can be manufactured cheaply and quickly without using copper and which can be controlled through pulses with a duration of one microsecond. This is achieved, according to the invention, in that instead of copper windings as exciting coils one or several coils of magnetic hard material are used, constructed in the shape of a toroidal tape core. The coils are magnetized through electrically directed pulses either in the same or in the opposite sense as the permanent magnet and, due to the high coercive force of the coil material, influence the operating air gap just as if they were controllable toroidal magnets.

According to a further feature of the invention the coil is wound of magnetizable tape, electrically insulated on at least one side, the insulation can also be made through methods know per se, as, for example, by a layer of enameled copper wires or by inserting a thin foil.

The invention includes a variant in which the coil is wound of magnetizable, electrically insulated wire. However, the filling coefficient and the possibility of magnetization is somewhat more unfavourable than when magnetizable tape material is used.

With regard to construction of the latching relay according to the invention all shapes known for latching relays with reed armature contacts are possible. The permanent magnet can be provided either as rod-type magnet outside the reed tube or it may enclose said reed tube as toroidal magnet. The exciting coil according to the invention can be arranged on the reed tube either beside or above the permanent magnet. It is also possible that two coils enclose the reed tube on either side of a toroidal magnet. Finally, several reed armature contacts with associated permanent magnets can be enclosed by one exciting coil according to the invention. In a particularly advantageous construction according to the invention an exciting coil according to the present invention is arranged beside an oxide toroidal magnet on the reed tube whereby both, exciting coil and toroidal magnet, are enclosed by a common insulating sleeve.

The latching relay according to the invention shows various substantial advantages. It can be easily manufactured particularly due to its simple and small construction. The coil, particularly consisting of tape material, can be quickly wound in the simplest manner without using copper, because simple and slowly rotating automatic winding machines can be used due to the small number of winding turns required. After the winding process the expansion of the coil, caused by the resilient property of the material, is prevented by sliding the insulating sleeve over the coil. Thereby, when the coil expands until said expansion is limited by the insulation sleeve, the internal diameter of the coil enlarges and the completely wound coil can easily be removed from the mandrel. Another advantage is that when the armature contact is closed, the coil supports the latching effect of the permanent magnet after the excitation pulse has been switched off due to the remanent magnetizing condition of its material. Thus for the latching relay according to the invention a considerably weaker permanent magnet can be used than for the constructions known in which the per-

manent magnet alone must produce the adhesive force. Thereby difficulties caused by tolerance fluctuations of different reed contacts can be largely eliminated. The most important advantage of the latching relay described, however, is that such a relay can be controlled even with extremely short pulses. The coil material can be changed from one magnetizing condition to the other one by an impulse having a period of one microsecond, thereby causing a suitably directed magnetic flux to switch the reed contact. This enables the use of the latching relay according to the invention also in electronic systems.

The invention is now described with the aid of an example. The accompanying drawing shows a cross section through an adhesive relay according to the invention. In the example a single reed contact **1** is shown, enclosed cylindrically by an arrangement, consisting of the oxide toroidal magnet **2**, the coil **3** wound of magnetizable tape material, and the insulating sleeve **5**. The electrical connections of the coil **3** are indicated by the number **4**. In order to open the contact the coil **3** is magnetized by a suitably directed impulse so that magnetic flux occurs which is directed oppositely to the flux of the oxide toroidal magnet **2**. Thus, the coil generated flux weakens the flux of said permanent magnet. The remanent magnetizing condition of the coil **3** maintains the magnetic flux after the pulse has ceased. If the armature contact shall be closed the magnetism of the coil **3** is changed by a suitably directed impulse (same direction as the permanent magnetic flux), so that the flux of the coil supports the flux of the permanent magnet whereby the contact closes. Here too, the coil influences the operating air gap, after the impulse has ceased, as a toroidal magnet, supporting the permanent magnet, guaranteeing a reliable latching of the contact armature. While the principles of the invention have been described above in connection with specific apparatus and applications, it is to be understood that this description is made only by way of example and not as a limitation on the scope of the invention.

What is claimed is:

1. A latching relay with reed armature contacts and a permanent magnet, magnetized to provide flux parallel to the contacts, coil means cylindrically encircling said contacts, said coil means wound of magnetically hard material, leads for connecting said coil means to be polarized through electrically directed pulses either in the same magnetic sense or in the opposite magnetic sense to the permanent magnet thereby controlling the operating air gap by aiding or negating the flux of supporting the magnet.

2. The latching relay according to claim **1** characterized in this that the coil is wound of magnetizable tape, electrically insulated at least on one side.

3. The latching relay according to claim **1** characterized in this that the coil is wound of magnetizable, electrically insulated wire.

4. The latching relay according to claim **2** characterized in this that the coil is arranged on the reed tube beside an oxide toroidal magnet and both, coil and toroidal magnet, are enclosed by a common insulating sleeve.

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