

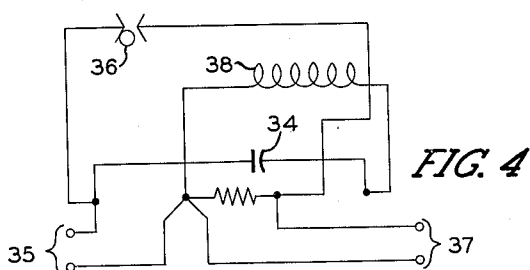
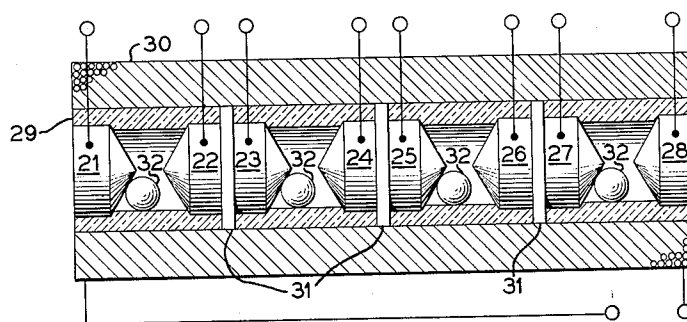
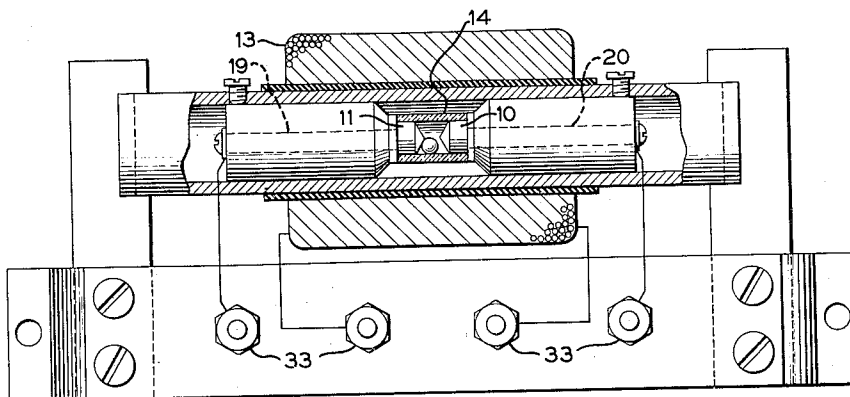
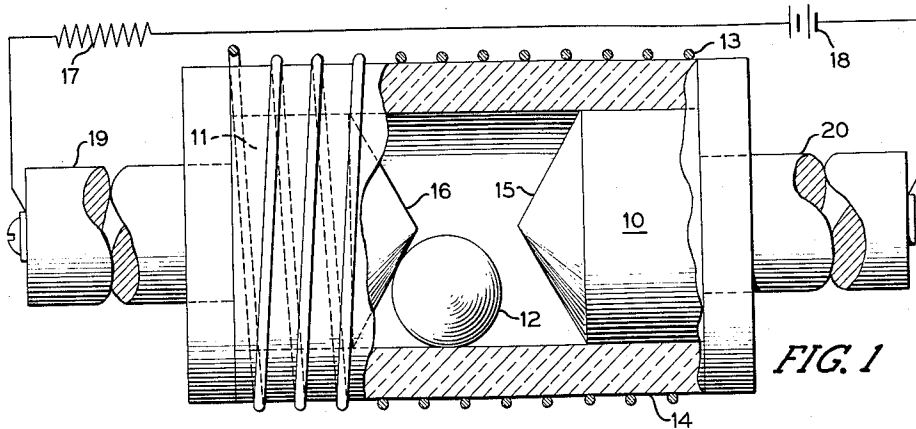
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ELECTROMAGNETIC RELAY

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ELECTROMAGNETIC RELAY

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2 Claims. (Cl. 200—103)

This invention relates to electromagnetic relays and has for its principal object an improved relay.

Another object of this invention is to provide a sensitive relay for controlling the switching of relatively large currents with a feeble operating current.

A further object of this invention is to provide a sensitive relay that is compact in construction and capable of operating in any position.

A still further object of this invention is to provide a relay in which the contact surfaces are constantly changing.

In carrying out the objects of this invention, an armature is placed in magnetic proximity to a plurality of magnetizable pole members in a space determined by confronting faces of the said members, which faces enclose a space having a part wider than the armature and a part narrower than the armature. A suitable support normally holds the armature in the part of the space wider than the armature. As an operating current is passed through a coil winding of a coil assembly for magnetizing the members, a resultant magnetic field causes a relative movement of the armature and the pole members so that the armature is moved within the aforementioned space from the said wider part to the narrower part in order to complete an electrical load circuit by bridging the pole members.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated of applying that principle.

In the drawings:

Fig. 1 is a front elevation of an electromagnetic relay with parts in section.

Fig. 2 is a front elevation of an electromagnetic relay on a suitable mounting with parts in section.

Fig. 3 is a diagrammatic view of a multi-contact electromagnetic relay with parts in section.

Fig. 4 is a schematic wiring diagram of a carrier frequency receiver tuned circuit utilizing an electromagnetic relay.

Referring to Fig. 1, a preferred embodiment of the electromagnetic relay includes three main parts: a pair of magnetizable pole members 10 and 11, a spherical magnetizable armature 12, and a coil winding 13. As is shown, the pole members are arranged in a spaced relationship within a non-magnetic cylinder 14 and are separated a predetermined distance so that the gap between the apices of their respective conical ends 15 and 16 is less than the diameter of armature 12 and the distance between the bases of the said conical ends is greater than the diameter of armature 12. Armature 12 is loosely placed intermediate members 10 and 11 within cylinder 14, and is free to contact either said member singly as the position of the relay is changed. Coil winding 13 is supported radially by cylinder 14 around the pole members. However, winding 13 may be supported in any manner

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by which a magnetic field is set up between the pole members.

As an operating or energizing current is passed through coil 13, a resultant magnetic field is set up between members 10 and 11. This causes armature 12 to be drawn magnetically into contact with both of the conical ends 15 and 16, thereby establishing an electrical load circuit. Thus, a load current will flow from one terminal of battery 18, through resistor 17, through extension 19 and conical end 16 of pole member 11, through armature 12, and through conical end 15 and extension 20 of pole member 10, to the negative terminal of battery 18. Similarly, an electrical load circuit might extend through insulated conductive caps or terminals on one or both pole members in a relay in which the pole members per se are not used in the load circuit.

When the energizing current through coil 13 is interrupted, the magnetic field between members 10 and 11 collapses, whereupon the load circuit current also is interrupted as armature 12 drops away from conical ends 15 and 16 due to the force of gravity.

The conical ends of members 10 and 11 and the surface of armature 12 may be plated with silver or any other highly conductive non-magnetic material to provide not only good contact conductivity, but also to afford a residual which will assist to break the relay contacts more rapidly.

As armature 12 is freely movable within cylinder 14, the contact surfaces by which the electrical load circuit is completed change each time the armature is attracted to the pole members. This, of course, reduces contact surface pitting considerably. The deteriorative effects of arcing may be further minimized by hermetically sealing the contact surfaces of the relay in an inert gas or a suitable quenching oil.

The electromagnetic relay as positioned on a suitable mounting for operation in any position is shown in Fig. 2. The coil winding and relay contact leads are brought out to suitable terminal positions 33 to facilitate making electrical connections thereto.

An embodiment of a multi-contact electromagnetic relay is shown in Fig. 3. Each pair of pole members 21—22, 23—24, 25—26 and 27—28 is positioned within sections of glass tubing 29 around which a coil winding 30 is supported radially. Insulators 31 separate the adjoining pole members electrically so that as an energizing current passes through winding 30, each of the armatures 32 will close a separate load circuit as it electrically connects a corresponding pair of pole members. When the energizing current through coil 30 is interrupted, each of the separate load circuits will be opened as the magnetic field collapses and the armatures 32 drop away from the tapered faces of their corresponding members due to the force of gravity.

The electromagnetic relay described hereinabove is extremely sensitive and will operate in response to a feeble energizing current. As a result thereof, it may be used in a tuned carrier frequency receiver such as that shown in Fig. 6 for remote control of secondary circuits. In any carrier current receiver there is normally a condenser and an inductance connected in series across the supply lines, the values of the condenser and inductance being such that the circuit will resonate at the carrier current frequency. The carrier current frequency is considerably higher than the commercial power line frequency and considerably lower than noise impulses, e. g., 3500 cycles per second. Consequently, the condenser offers a very high impedance to the power line currents and the inductance offers a very high impedance to the transient noise impulse currents. By using the tuned coil directly as the electromagnetic relay coil winding, the said relay

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will be rendered operative whenever a carrier frequency current is applied to the supply lines.

For carrier frequency and alternating current operation, it is preferable to use core material that will operate with low eddy current loss. Various materials may be used for this purpose, such as molded powdered iron and magnetic ferrites of laminated construction. Conductive caps on the pole members as described hereinbefore are used to complete the electrical load circuit.

Referring to Fig. 4, the relay coil winding 38 and condenser 34 are connected in series circuit across power supply lines 35. As the carrier frequency current to which coil 38 and condenser 34 are tuned, is applied to supply lines 35, contact 36 will close the circuit to load lines 37. When the carrier frequency current is interrupted, the magnetic field caused by the carrier frequency current passing through coil 38 will collapse, thereby causing contact 36 to open.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. An electromagnetic relay of the class described comprising a coil, a housing for radially supporting said coil, a plurality of armatures, a plurality of pairs of tapered pole members positioned in a spaced relationship within said housing so that the apices of each pair of said pole members are separated a distance less than the diameter of one of said armatures, each of said armatures being loosely arranged within said housing intermediate a related pair of said pole members and being movable to

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electrically connect a related pair of said pole members in response to an energizing current through said coil, and means for electrically insulating each pair of said plurality of pairs of pole members one from the other so as to provide a corresponding number of separate switches.

2. In an electromagnetic device having a plurality of spherical electrically conducting armatures and a plurality of pairs of electrically conducting pole members, one of said armatures for each pair of said members; a housing supporting said members in a space relationship so that confronting faces of each pair of said members define a space wider in one part and narrower in another part than the one of said armatures relating thereto; said housing additionally supporting each of said armatures in the wider part of the space intermediate the pair of said members relating thereto and out of contact with at least one of said members relating thereto; electric circuit means including a coil for magnetizing said members in accordance with an energizing current through said coil so as to cause each of said armatures to move towards the pair of said members relating thereto, whereby each of said armatures is positioned in the narrower part of the space intermediate the pair of members relating thereto so as to bridge the space therebetween by contacting both of said members; and other electrical means forming a plurality of electric circuits each of which circuits includes a pair of said members bridged by the one of said armatures relating thereto.

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