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ELECTRICALLY POLARIZED REED RELAY

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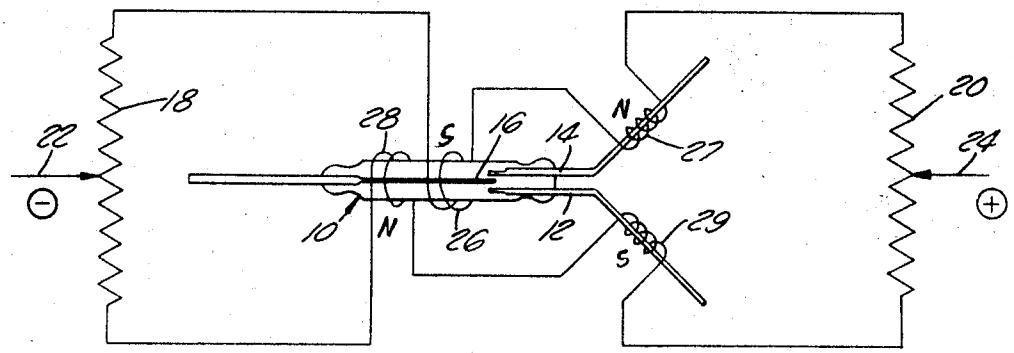


FIG. 1.

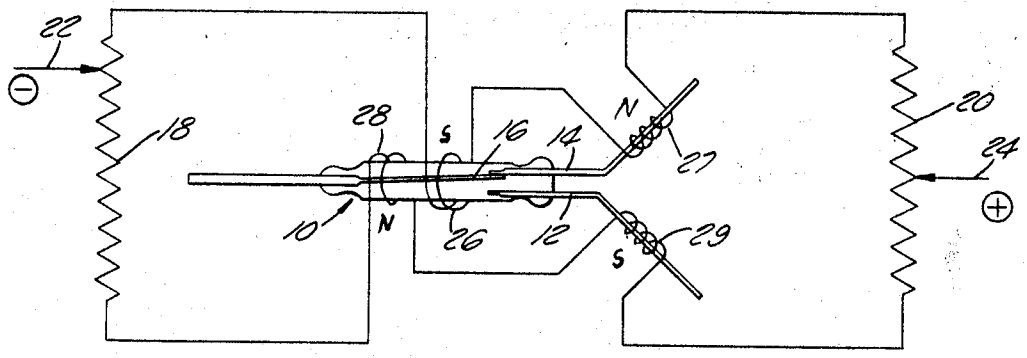


FIG. 2.

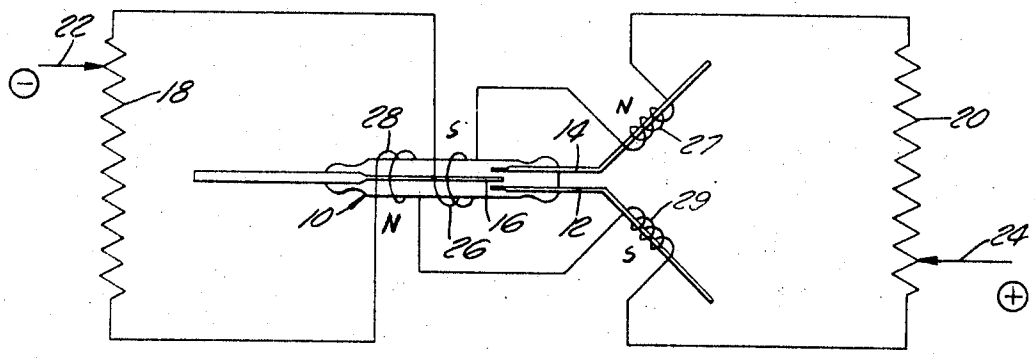


FIG. 3.

INVENTOR.
JOHN F. McNULTY

BY Pennie & Edmonds

ATTORNEY

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ELECTRICALLY POLARIZED REED RELAY

John F. McNulty, Glendale, Calif., assignor to International Telephone and Telegraph Corporation, New York, N.Y., a corporation of Maryland

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ABSTRACT OF THE DISCLOSURE

A reed relay is enclosed in a tubelike glass structure has one movable contact carrying member and two fixed ones. A first winding surrounding the movable member is serially connected to a second winding about one of the fixed contact carrying members to define a first winding set. A second winding set is provided for the movable and remaining fixed members. The windings of each set are connected such that an energizing current produces opposite magnetic polarity conditions in respective members of each set. A first potentiometer is connected between the free ends of windings on the movable member and a second potentiometer is connected between the free ends of the windings on the fixed members. Switching control voltage is applied across selectively adjustable slidewire contacts of the potentiometers.

This invention relates to electrical switching apparatus and more particularly to an electrically polarized reed relay of the two pole single throw type.

In view of the many new uses for relay switching devices, it is of course desirable that relays be designed and developed with improved characteristics to satisfy the requirements of these various uses. For example, new military and space operations often impose severe size and environmental requirements on relays. Hence, it is a primary object of this invention to provide an improved versatile reed relay switching device.

It is a further object of this invention to provide an electrically polarized reed relay having positive snap acting operation of the relay movable contact.

It is a further object of this invention to provide a unique reed relay which is vibration insensitive to a high level of gravitational force and can be located or oriented in any position.

It is another object of this invention to provide a relay which presents a neat clean package easily adaptable to waterproofing, corrosionproofing, and explosionproofing.

Briefly stated, the invention includes a pair of spaced contacts and a common movable contact located between the spaced contacts to selectively engage one or the other of the spaced contacts together with a unique bridge-type circuit for controlling the switching condition of these contacts. The bridge circuit includes a pair of control potentiometer resistances and a movable tap for each resistance dividing the circuit into two legs. A pair of oppositely wound coils, thus having opposing polarities, are serially connected in each leg of the circuit between two adjacent ends of the resistances. A coil of one leg is positioned in flux linking relation with one of the spaced contacts and a coil from the other leg having an opposite polarity is positioned in flux linking relation with the other spaced contact. The remaining two coils, which are also of opposite polarity, are located in flux linking relation with the common contact. With the coils arranged in this fashion, the fields produced by the coils for the spaced contacts are equal and opposite when the potentiometer taps are positioned so that the resistances in the legs are equal, and the field produced by the coils for

the common contact are also equal and of opposite polarity. Consequently, the common contact is held in a neutral position, but movement of one of the taps to vary the resistance in the legs will vary the position of the common contact relative to the spaced contacts. Preferably, the common contact is mounted on the end of a flexible reed and the reed together with the spaced contacts are sealed within a glass envelope.

Further features and advantages of the invention will become apparent with reference to the following description and drawing which includes three circuit diagrams of the relay of the invention in various stages of operation.

Referring now to the drawing, the relay switch contacts are shown mounted within a glass envelope **10** and includes a pair of spaced contacts **12** and **14** fixed in one end of the envelope in position to cooperate with a common movable contact **16** which is in the form of a flexible reed having one end free to move and its opposite end mounted in the opposite end of the envelope. As shown in FIG. 1, the common contact **16** is positioned midway between the two spaced fixed contacts **12** and **14** so that the switch is in an open position. Since the reed is flexible, it can move upwardly to engage fixed contact **14**, as indicated in FIG. 2, or move downwardly to engage fixed contact **12**. The ends of contacts extending outwardly from the glass envelope **10** are, of course, adapted to be connected to the desired electrical circuit components.

In accordance with the invention, the movement of reed **16** is controlled in a novel manner by a bridge-type circuit. As seen from the drawings, the circuit includes a pair of potentiometer resistances **18** and **20** each having a movable tap **22** and **24** which divides the circuit into two legs and which are adapted to be connected to a source of power. One leg of the circuit includes a pair of coils **26** and **27** serially connected between one end of resistance **18** and one end of resistance **20**. Coils **26** and **27** are wound in opposite directions so that they have opposite polarity from one another. In the drawing, coil **26** is indicated as having a south polarity while coil **27** is indicated as having a north polarity. The other leg of the circuit has a similar arrangement with coils **28** and **29** being oppositely wound to have opposite polarity and being serially connected between the other end of resistance **18** and the other end of resistance **20**.

As can be seen, coil **27** is wound in flux linking relation around the fixed contact **14** while coil **29**, having a polarity opposite to that of coil **27** is wound around the other fixed contact **12**. The other two coils, **26** and **28**, which are also of opposite polarity to each other, are both wound in flux linking relation around flexible reed contact **16**.

When the bridge circuit is in balance as shown in FIG. 1, coils **27** and **29** produce the same flux potential and have equal attraction to the common contact **16**, by having an equal number of turns of the same wire. Coils **26** and **28** are both wound on the same bobbin with an equal number of turns, but no effective force is produced since the coils are wound in opposite directions, with the result that center contact **16** remains in a neutral position not engaged with either of the fixed contacts.

When the bridge circuit is unbalanced by changing the resistance of control potentiometer tap **22**, as shown in FIG. 2, the reduced resistance in the top leg of the circuit causes an increased flux produced by coil **26** and a decrease by coil **28**. Consequently, center contact **16** assumes a south polarity and is attracted to the normally opened contact **14**, which has a north polarity thus completing a circuit from contact **16** to contact **14**. The increased current flow through coil **27** and the simultaneous reduction of current through the other leg of the circuit reduces the flux produced by coil **29**. Consequently,

contact **16** snaps quickly to the closed position with contact **14**.

When the follow-up potentiometer tap **24** is moved to the balanced position with respect to tap **22**, as shown in FIG. 3, the bridge circuit is again in balance and no magnetic flux is produced on center contact **16** with the result that the circuit is broken between contact **16** and contact **14** and the movable contact **16** is returned to its neutral position as seen in FIG. 3.

It will be understood that similar operational steps occur when the bridge circuit is unbalanced by changing the position of resistance tap **22** in the opposite direction from that of FIGS. 2 and 3. With this reverse operation contact is made between movable contact **16** and fixed contact **12**.

Since the position of the flexible reed is positively determined by the control circuit, it is operable in any orientation and is able to withstand high vibration levels without faulty operation. Also, by wrapping the control components around the glass encased contacts, the combined unit forms a neat and clean package which can be easily protected from moisture, corrosion, and other environmental conditions.

What is claimed is:

1. An electrically polarized reed relay comprising:

a pair of spaced contacts;

a common contact positioned between said spaced contacts and adapted to cooperate with said spaced contacts by being selectively engaged with said contacts;

a series bridge circuit including a pair of control potentiometer resistances, a movable tap for each of said resistances dividing the circuit into two legs, with each of said legs including a pair of coils of opposite polarity serially connected between respective ends of said resistances;

a first one of said coils from one of said legs being positioned in flux linking relation with one of said spaced contacts;

a second one of said coils from the other of said legs being positioned in flux linking relation with the other of said spaced contacts and having a polarity opposite to that of said first coil;

and the remaining coil from each of said legs being positioned in flux linking relation with said common contact;

said coils being arranged so that when said taps are positioned to equalize the resistance in said legs, the fields produced by the coils for said spaced contacts are equal and opposite and the fields produced by the coils for said common contact are equal and opposite whereby said common contact is in neutral position and whereby movement of one of said taps in one direction to vary the resistance in said legs will move said common contact into engagement with one of said spaced contacts and movement of said one tap in the opposite direction will move the common contact in the opposite direction into engagement with the other of said spaced contacts.

2. The relay of claim **1** wherein said spaced contacts are fixed and said common contact is movable.

3. The relay of claim **1** wherein said contacts are sealed within an envelope with means attached thereto extending therefrom for connection to electrical components.

4. The relay of claim **3** wherein said common contact is mounted on a free end of a flexible reed having its other end fixed to said envelope, and said spaced contacts are mounted to said envelope on opposite sides of said common contact in the movement path of said flexible reed.

5. The relay of claim **1** wherein said first and second coils produce an equal amount of magnetic flux for a given current and the coils in flux linking relation with said common contact produce an equal amount of flux for a given current.

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JOHN F. COUCH, *Primary Examiner.*

W. M. SHOOP, JR., *Assistant Examiner.*

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317—150, 155.5; 335—78, 151, 230, 235, 266