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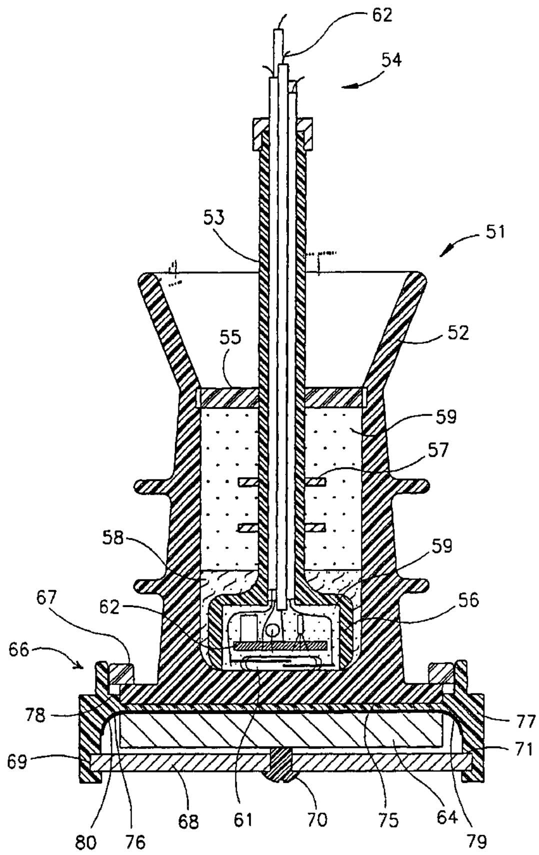
(54) Title: REED RELAY SWITCHES

(57) Abstract

A reed relay switch assembly designed to decouple high voltage from low voltage by separating and shielding the high voltage applied to a source of magnetic flux used to operate the switch from the switch.



REED RELAY SWITCHES

FIELD OF THE INVENTION

The present invention relates generally to magnetically operated switches for opening and closing circuits. More particularly, the invention relates to assemblies of reed relay switches used to galvanically decouple the relay operating voltage and the system controlled by the relay, for example, when the magnetic field source is in a high potential circuit, and the contacts control a component operating at normal potentials.

BACKGROUND TO THE INVENTION

Probably the most common galvanic decoupling units in use are those that operate opto-electronically i.e., those which contain light elements. The opto-electric units are relatively noise immune and are insensitive to electromagnetic fields.

However, in practice, light pulse shapers on the transmitting end and amplifiers on the receiving end of the opto-electronic devices have low activation levels and are therefore susceptible to damage by pulse noise on the side of the high-voltage power equipment. This fault negates the main advantage of the opto-electronic system. A further problem with the opto-electronic decoupling units is that the light diodes used as light emitting elements have inadequate lifetimes. Accordingly, alternative decoupling units are needed, especially for high-voltage decoupling i.e., where the potential differences are in the range of or over 45 kv.

Reed relay type switches are well-known. However, the use of reed relay type switches as galvanic decoupling units has not met with success to date. A drawback of the above mentioned relay is its limited field of application due to the low level of working voltage caused by such things as a high-voltage electric field associated with the relay when it is in the vicinity of and connected across a series component in the high-voltage line.

SUMMARY OF THE INVENTION

According to an aspect of some preferred embodiments of the present invention, the adverse effects of high voltage, i.e. leakage and corona effects are drastically reduced. More particularly, the magnetic field source in the high potential circuit and the reed relay switch are housed in separate compartments and electro-statically shielded from each other. In a preferred aspect of the present invention, at least one conducting element is positioned between the high and the low voltage portions of the device. In some preferred embodiments of the invention, either a true ground connection or a chassis ground is connected to the conducting element in order to better shield the assembly from the build-up of electrostatic forces caused by the high potential circuit. In others, the conducting element is allowed to float.

Corona is made up of free electrons in space. The electrons are attracted to the ground connection. The shielding between the contacts and the high-voltage flux source by the grounding reduces the corona. Further, the separate compartments are housed in high-voltage insulators. To reduce arcing, the insulators have rounded corners, and protrusions are avoided or minimized.

Alternatively or additionally, in some preferred embodiments of the invention, the reed relay switch is further enclosed within one of the high-voltage insulators. The high-voltage insulator is preferably filled with a filler such as epoxy to eliminate air-filled spaces that are conducive to corona build-up. Preferably, at least a part of the filler is conductive. In one preferred embodiment, the epoxy may be grounded either to true ground or to chassis ground to further improve the shielding. Even if not grounded, the conductive material prevents voltage gradients.

According to an aspect of some preferred embodiments of the invention, a circuit is provided for signaling the presence of the high voltage.

In an aspect of some preferred embodiments of the invention, a bus bar seat is provided that uniquely couples the reed relay switch to a flux generating, high-voltage bus bar in a way that also virtually reshapes the bus bar to reduce the corona emanating from the bus bar.

In a preferred embodiment of the invention the reed relay switch is in a container enclosed in one of the insulators, at least partially filled with conductive epoxy. A conductor grounded to chassis ground or to true ground may be juxtaposed to the reed relay switch to prevent arcing and/or to avoid the effects of static electricity in the vicinity of the reed contacts.

According to a preferred aspect of the invention, the sensitivity of the switch i.e., the magnetic flux density, where the switch will operate either from an open to a closed position or from a closed to an open position, is controlled. The control is preferably exercised by rotating the reed relay switch relative to the source of magnetic flux (or vice versa) through up to 90 degrees. The source of magnetic flux can be, for example, a coil or a bus bar carrying electric current. Another important aspect of the inventive galvanic decoupling is the use of at least one conductive surface between the rotating and the stationery parts to minimize the field caused by the high voltage on any air gaps between the stationary parts.

In general, according to various aspects of the invention, a reed relay switch operated by a magnetic flux source is provided. At least one contact of the switch is ferromagnetic and opens and closes in response to a desired magnetic flux. High-voltage caused problems are reduced by locating the contacts and the source of magnetic flux in separate insulated compartments. Another aspect of the invention prevents arcing by shielding the reed relay switch with a conducting element and alternatively or additionally by grounding the shielding. Yet another aspect of the invention reduces arcing by using a reed relay switch assembly that has no sharp corners and no protruding elements. Still another preferred aspect of the invention includes arrangements for controllably varying the sensitivity of the reed relay switch, without inducing regions of high field intensity between stationary elements and elements that move. There is thus provided in accordance with a preferred embodiment of the invention an assembly comprising a reed relay switch having at least first and second contact elements with at least one of said at least first and second contact elements being of a ferromagnetic material that is operated to change the state of the reed relay switch responsive to magnetic flux. A circuit at high potential produces the magnetic flux; and an arrangement is provided for decoupling said high potential. The arrangement includes placing the source of magnetic flux and the contacts in separate compartments shielded from one another. Preferably, the source of magnetic flux comprises a coil for generating the magnetic flux that is applied to the reed relay switch contacts. Alternatively, the source of magnetic flux comprises a conducting bus which generates the magnetic flux that is applied to the reed switch contacts.

In a preferred embodiment of the invention, the arrangement for decoupling said high potential precludes arcing. In a preferred embodiment, the arrangement includes having spaces in each of the separate compartments that are not taken up by necessary items such as the coils or the reed relay switch contacts filled to minimize empty spaces that are conducive to the build-up of electrostatically generated corona. Preferably, the conductors bringing high voltage to the source of magnetic flux are also housed in separate insulated compartments. Preferably, the separate compartments are electrostatically-shielded from each other. Preferably, the arrangement for galvanically decoupling said high potential includes a conductive element located to substantially surround the reed relay switch contact elements. Preferably, the conductive element is located between the high-potential circuit and the reed relay switch. In a preferred embodiment the conductive element comprises conductive epoxy. Alternatively, the conductive element comprises conductive grease.

In a preferred embodiment of the invention, a system is provided for controlling the operating point of the reed relay switch contacts. Preferably, the system for controlling comprises the separate compartments being rotatable relative to each other. Preferably, a two-surface interface between the separate compartments is provided with conductive material coating at least one of said two surfaces. Preferably, the system for controlling the operating point of the reed relay switch comprises arranging the reed relay switch to be rotatable relative to the source of magnetic flux. In a preferred embodiment of the invention circuitry is provided for indicating the presence of high voltage. Preferably, the source of magnetic flux is a bus bar at a much higher voltage than the voltage switched by the contacts.

There is further provided an assembly comprising: a reed relay switch; a high-potential circuit for providing magnetic flux for operating the reed relay switch. The high potential circuit includes a high-voltage bus bar. A bus bar seat is provided for attaching the switch to the bus bar. The seat extends beyond the reed relay switch along the bus bar. The seat includes a flat portion with a conducting coating between the seat and the bus bar to provide a shield restricting the spread of corona caused by the high voltage. Preferably, the reed relay switch assembly includes a threaded nut for attaching the reed relay switch assembly to the bus bar seat. Internal threads are provided on a portion of the seat for receiving the threaded nut and clamping the reed relay switch assembly to the bus bar seat. The threaded nut is produced from a dielectric material. Preferably, the seat includes an attaching arrangement for attaching the seat to the bus bar. The attaching arrangement includes a clamping arrangement for forcing a conductively coated portion of the seat against the bus bar.

In a preferred embodiment of the invention, the clamping arrangement comprises the seat having oppositely disposed legs that extend beyond said bus bar with a slot located in each of the legs. The slots are spaced apart from the conductively coated portion of the seat. A non-ferrous plate is inserted into the slots. A threaded hole is located in said plate and a threaded fastener threaded into the threaded hole forces the conductively coated portion of the seat against the bus bar.

There is further provided a switching assembly that includes a reed relay switch. A high-potential circuit provides a source of magnetic flux for operating the reed relay switch. The reed relay switch and the source of flux are movable relative to one another to control the sensitively of the reed relay switch. Electrostatic shielding material is located between the source of flux and the reed relay switch to shield the reed relay switch from the high voltage. Preferably, the shielding material includes a spacer element between the source of magnetic flux and the reed relay switch. The reed relay switch is attached to the spacer element so as to move together within the reed relay switch assembly and to vary the sensitivity of said reed relay switch. The surface of the spacer element is juxtaposed to a surface of the reed relay switch assembly with at least one of the surfaces being coated with a non-ferromagnetic conducting material. Preferably, the relative movement for varying the reed relay switch sensitivity is rotational.

There is further provided a reed relay switch assembly, comprising a reed relay switch having contacts operated by a high-voltage source of magnetic flux. A non-ferromagnetic conductive material encloses the reed relay switch. Preferably, the reed relay switch assembly includes a non-ferromagnetic conducting material encasing the source of magnetic flux. Preferably, the reed relay switch assembly includes galvanic decoupling between the source of magnetic flux and the reed relay switch. Preferably, the galvanic or electrostatic separation is accomplished with a conducting element located between the source of magnetic flux and the reed relay switch. Preferably, conducting element is non-ferrous.

There is further provided a reed relay switch assembly, comprising a bus bar at high voltage providing magnetic flux. A reed relay switch is operable by the magnetic flux. Circuitry is provided for indicating the presence of the high voltage. Preferably, the circuitry for indicating high voltage includes an antenna arranged to detect said high voltage and provide received signals. An amplifier is coupled to the antenna to amplify the received signals. An indicating device is operated responsive to the amplified signals to indicate the presence of the high voltage. Preferably, the antenna comprises a conducting filler surrounding the reed relay switch.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the invention believed to be novel are set forth with particularity in the appended claims. The invention itself, however, both as to arrangement and method of operation, together with further objects and advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a sectional drawing of a reed relay switch assembly, according to a preferred embodiment of the present invention;

Fig. 2 is a sectional drawing of a reed relay switch assembly according to another preferred embodiment of the present invention;

Fig. 3 is a plan view of a bus bar seat that is shown in cross-section in Fig. 2; and

Fig. 4 is a schematic drawing of an amplifier shown in Fig. 2.

DESCRIPTION OF PREFERRED EMBODIMENTS

A reed relay switch assembly 21, according to a preferred embodiment of the invention, is shown in Fig. 1. It is comprised of a high-voltage insulator 22 preferably formed as a cylinder-shaped envelope formed of an insulating material with a horizontally extending flange 31 spaced from its bottom. The envelope changes smoothly throughout its length from its horizontal top along its vertical walls to the horizontal flat-bottom below flange 31. The high-voltage insulator is preferably made from a high temperature dielectric with a low coefficient of linear expansion and good adhesion to epoxy compounds. An example of such a high-temperature dielectric is a radio frequency ceramic.

A source of magnetomotive force or magnetic flux (MMF) for operating the reed contacts is shown in Fig. 1 as a winding 23 wound on a ferromagnetic t-shaped core 24. The invention is not limited to 7t-shaped cores; other shapes could also be used. However, ir-shaped cores are more efficient. The reed relay switch, encapsulated in the glass container, is shown at 26. Note that, according to one aspect of the invention, as shown in Fig. 1, the source of magnetomotive force i.e., winding 23, is connected across a component (not shown) in series in a circuit at high voltage. Alternatively, the winding 23 is connected in series in the high-voltage circuit. In either case, the winding is separated from and effectively is in a different compartment than is reed relay switch 26. While this physical separation aids in preventing static electricity originating in the high-voltage circuit from adversely affecting the reed relay switch; more preventive measures are applied as will be explained hereinafter.

High-voltage conductors used in connecting the coil to a high voltage source are shown at 27. The high-voltage source is in the neighborhood of, for example, up to 45,000 volts or more. Thus, the conductors 27 are well insulated. The insulation preferably includes a tubeshaped additional high-voltage insulator 28 shown in the drawing. It is formed with a finned outer surface as a pipe-like insertion into main insulator 22.

To further minimize corona and any other adverse electrostatic effects, the inside of high-voltage insulator 22 is filled with two layers of epoxy; a lower layer 17 that preferably encapsulates the coil and an upper epoxy layer 18, to eliminate trapped air which is conducive to forming corona. The lower layer is preferably made conductive by adding a conductive material such as copper powder to the extent of 50 to 60% of the total compound volume. The conducting material surrounding the insulated varnished wires of the coil 23 shields the high voltage by precluding static voltage gradients.

High-voltage insulator 22 is shown as having a cover 29, preferably of a dielectric material. The cover is preferably secured in place by external threads 30a which mesh with internal threads 30b in the high-voltage insulator 22. The threaded fastening is used for retaining the epoxide.

High-voltage insulator 22 gently slopes outwardly and terminates in the flange 31, which is used for fastening assembly 21 to circuit boards, bulkheads or the like, such as shown at 25, to couple the reed relay switch assembly to other components. Main insulator 22 extends below the flange in an extended cylindrically-shaped insulator body section 32. Note there are no sharp corners or protrusions that are conducive to static electricity build-up either on main insulator 22 or extended insulator body section 32.

Means for shielding reed relay switch assembly 21 from the high voltage are preferably provided. For example, the extended cylindrically-shaped insulator body section 32 forms a hollowed-out section that contains the reed relay switch 26 in an independent sub-assembly 35. Sub-assembly 35 includes shielding provided by a conductive spacer element 33 which preferably has a shape corresponding to the outline of the hollowed-out section of the extended cylindrically-shaped insulator 32.

Alternatively to the conductive space element 33, conducting material 33a is coated to onto the extended cylindrically-shaped insulator body section 32 between it and spacer element 33. The conductive material 33a is preferably coupled to either chassis or true ground at 41, but may also be floating The spacer element may have a surface that is plated with a conducting material and filled to abut the cup-shaped depression into which element 33 fits. The conducting material 33a assures that any air between elements 33 and 33 will not be subject to any electric field. Spacer element 33, insulator 32 and conducting material 33a are all at the same potential.

High electric field on air spaces are conducive to corona build-up. The sub-assembly further preferably includes a pipe-like additional element 34 which is preferably topped by a dish 36 containing the reed relay switch 26 affixed therein. The conducting material 33a in one preferred embodiment is a conductive grease, which assures that there are no air spaces between the spacer element 33 and the insulator 32.

Spacer 33 with conductive material 33a acts effectively to divide the reed relay switch assembly 21 into two parts, and provide galvanic isolation. The top part is exposed to the high voltage and develops the magnetic flux necessary to operate the switch. The bottom part includes the switch. The high voltage is shielded by the conducting material 33a from the lower voltage on the reed relay switch, adding to the galvanic isolation.

The spacer 33, additional insulator 34 and the reed relay switch 26 are affixed to disk 37 as part of sub-assembly 35. The cavity, defined by spacer 33 and disk 37, is filled with a f i ller 38 such as an epoxy compound. The sub-assembly is rotatable in the cavity and is held in place by turning disk 37 which preferably is threaded and screws into insulator body 32. This varies the sensitivity of the reed relay switch 26 contacts. Rotating the sub-assembly 35 varies the alignment of the contacts with the magnetic field and thus changes the amount of MMF necessary to operate the contacts.

The additional insulator 34 surrounds the conductors 40 carrying the current to the overlapping elements of the reed relay switch and partially encases the reed relay switch. Note that cavities are filled to replace the air which would normally be in the cavity. In a preferred embodiment, a non-conductive epoxy compound shown as 38 is used to fill the cavity of sub-assembly 35 to aid in the decoupling. In effect, reed relay switch 26 is shielded by conducting material 33a, which may be floating, grounded or attached to one leg of the reed relay switch. Preferably, all conductors not used for shielding are covered or coated by an insulator.

While Fig. 1 shows the adjustment of the threshold for operating the reed relay switch controlled by rotation of the reed relay switch itself, it could also be controlled by a movement of the coil. For example, if the coil or any other source of magnetic flux was mounted in a rotating part of the assembly, and the reed relay switch was mounted within the non-rotating part of the assembly, then the switch's operational threshold would vary, according to the rotation of the source of the magnetic flux, rather than the rotation of the reed relay switch.

It should be noted that while a cylindrically-shaped body 22 is described, the body could be of any volume containing shape that preferably has no sharp corners or protrusions and that has sufficient volume to hold the coil and the additional high-voltage insulator, bringing the conductors to the coil.

Note that in the design of the assembly of Fig. 1, sharp corners, protruding screws or metallic members which create a corona are minimized. Further, there is preferably provided, as is shown in Fig. 1, a clamping nut 39, which preferably is made of a dielectric material, and is used to clamp the assembly in place on a circuit board, for example. The clamping nut 39 is threaded, as is the outer surface of the extended cylindrical part 32. The present reed-switch assembly utilizes threaded plastic parts rather than metallic fasteners to minimize production of a corona. Thus, for example, the top cap or cover 29 that is threaded into main insulator 22 is preferably formed of an insulator. In addition, in one preferred embodiment, the disk 37 threads into the extended cylindrical part 32 of the main insulator 22. The switch 26 itself is held in position by pressure of disk 37 which is preferably an insulating material.

The surfaces of sub-assembly 35 (especially of element 33) are rounded as much as possible, so that there are no sharp comers. This preserves the isolation of the high voltage being applied to the assembly. Thus, in Fig. 1 decoupling is achieved by the separation of the high-voltage components and the switch contacts into separate compartments, by the shielding provided by the conductive material within the compartments, by the absence of protruding parts, by the absence of sharp corners and by the filling of air spaces with epoxy.

A second embodiment of an aspect of the present invention is shown in Fig. 2 which is a sectional view of another reed relay switch assembly 51 operated by a high-voltage magnetic lfux generator. The assembly comprises a bottle-like high-voltage insulator 52 made of a dielectric material such as dielectric glass or ceramic. A top cover 55, preferably of insulating material, is provided. The top cover screws into insulator 52.

A separate insulator 53 is used to bring conductors 54 from reed relay switch 61 to the controlled apparatus (not shown). The separate insulator is depicted as having an extended pipe-like finned body 53 terminating at its bottom in an upside down bowl-like rounded dish 56. The fins, such as fin 57, support the thick-walled pipe-like insulator 53 within insulator 52. A conducting compound 58, which may be epoxy laced with up to 60% of its volume with copper powder, is used to externally cover the bowl 56. A non-conducting compound, such as plain epoxy resin 59 is preferably used to fill the bowl and hold reed relay switch 61 in place. However, conductive material 58 is preferably present below switch 61 such that it is entirely encased in conductive shielding material.

The conducting compound 58 may be coupled through a conductor directly to either chassis, one side of switch 61 or to true ground. Alternatively, it may be floating.

In Fig. 2, the source of magnetic flux is the current flowing through a conducting bus bar 64. A bus bar seat 66, which is preferably fabricated from a non-conducting plastic, is affixed to the bus bar 64. The bus bar seat 66 and the insulator 52 are preferably mechanically locked to each other with a dielectric nut 67.

The operating point of the reed relay switch is varied by loosening the dielectric nut 67 and rotating the insulator body 52 with reed contacts 61 therein relative to the conducting bus 64.

The bus bar seat 66 is held to the bus bar 64 using a non-ferromagnetic plate such as an aluminum plate 68 that is mounted in slots 69 in downwardly extending legs such a leg 71 of the bus bar seat 66. A fastener 70 holds the seat 66 on the conducting bus 64.
A conductive coating, indicated at 76, is preferably applied between the bus bar seat 66 and the bus bar 64. The conductive coating 76 has no sharp corners and thus provides non-breakdown contact between the bus bar and the seat and acts to further shield the high voltage from the other parts of the assembly and further prevents static voltage gradients and, therefore, substantially eliminates arcing. Note that the seat is an insulator that effectively surrounds the bus bar. Preferably, the flat mating surfaces between insulator 52 and seat 66 are also coated with a thin conductor or conductive grease 75 to shield air spaces between insulator 52 and seat 66.

Fig. 3 is a plan view of the bus bar seat. Preferably, seat 66 is a molded or machined plastic unit that extends lengthwise parallel to the bus bar 64. Preferably, the high-voltage insulator body 52 fits into the circular area defined by shoulder 78. Externally threaded nut 67 locks assembly 51 into place when screwed into the threaded wall 77.

Thus, the embodiment of Fig. 2, among other things, substantially eliminates arcing by avoiding protruding elements and sharp corners, by shielding the sharp cornered bus bar for a substantial distance from the low voltage and by preventing voltage gradients along the bus bar to effectively eliminate corona caused arcing. The bus bar seat grasps the bus bar without using any metal exposed in the direction of the low-voltage and without needing holes in the bus bar. Note particularly the fillets at 79 and 80.

According to an aspect of the invention, as shown in Figures 2 and 4, the conducting compound acts as an antenna and is used to detect the presence of a high voltage, and therefore, to signal when high voltage has been applied. When there is high voltage present, the static voltage is applied at the conducting compound 58. A high-resistance amplifier 62 detects the voltage and operates a load which can be a normally open relay that signals the presence of the high voltage. For example, the relay operates an indicator that the high voltage is present. Of course, the circuit could be set to operate a normally closed relay.

As illustrated in Fig. 4, the voltage at the input to amplifier 62 causes current flow through resistor RI, which also causes transistor Q1 to turn on. This in turn causes transistor Q2 to conduct, enabling current flow from voltage + g through a load 63, resistor R2, through the transistor Q2 to ground. Transistor Q1 causes capacitor Cl to charge. When capacitor C1 is charged transistors Q3 and Q4 are turned on to cause sufficient current to flow through the coil of load on relay 63, transistor Q4 and resistor R3 to operate the relay 63 to signal that high voltage is applied to bus bar 64.

The transistors are preferably bipolar composite transistors. The antenna-like conducting compound 58 is energized with alternating current by the static electricity from the high voltage. Diode D1 acts as a rectifier, while the zener diode Z1 act as a regulator. Other circuitry could be used that would operate relay 63 responsive to a high-voltage on the bus bar.

The foregoing description of the specific embodiments of the present invention have been presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obviously, many modifications and variations are possible in light of the above teaching. The embodiments were chosen and described in order to best explain the principles of the invention and the practical application, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications, as suited for the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto and their equivalence.

The terms "include", "comprise" and "have" and their conjugates, as used herein mean "including but not necessarily limited to".

CLAIMS

1. A device comprising:

a reed relay switch assembly including a reed relay switch having at least first and second contacts;

at least one of said at least first and second contacts being of a ferromagnetic material that is operated to change the state of the reed relay switch responsive to magnetic flux;

a source at high potential that produces said magnetic flux; and

an arrangement for decoupling said high potential

said arrangement including placing said source of magnetic flux and said contacts in separate compartments.

2. The device of claim 1 wherein the source of magnetic flux comprises a coil for generating the magnetic flux.

3. The device of claim 1 wherein the source of magnetic flux comprises a conducting bus which generates the magnetic flux.

4. The device of claims 2 or 3 wherein the arrangement for decoupling provides that spaces in each of the compartments that are not taken up by necessary items such as the coil or the reed relay switch are filled to minimize empty spaces that are conducive to the build-up of electrostatically generated corona.

5. The device of any of the preceding claims wherein conductors bringing high voltage to the source of magnetic flux are housed in separate insulated units.

6. The device of claim 5 wherein the separate compartments are electrostatically shielded from each other.

7. The device of any of the preceding claims wherein the arrangement for decoupling includes a conductive element located to substantially surround the reed relay switch.

8. The device of any of the preceding claims including a conductive element located between the high-potential circuit and the reed relay switch.

9. The device of claim 8 where the conductive element comprises conductive epoxy.

10. The device of claims 8 or 9 where the conductive element comprises conductive grease.

11. The device of any of the preceding claims including a system for controlling the reed relay switch operating point.

12. The device of claim 11 wherein the system for controlling comprises the separate compartments being rotatable relative to each other.

13. The device of claim 12 including:
a two-surface interface between the separate compartments; and
conductive material coating at least one of said two surfaces.

14. The device of any of claims 11, 12 or 13 where the system for controlling the operating point of the reed relay switch comprises arranging the reed relay switch to be rotatable relative to the source of magnetic flux.

15. The device of any of the preceding claims including circuitry for indicating the presence of high voltage.

16. The device of any of claims 1-15 wherein the source of magnetic flux is associated with a much higher voltage than the voltage switched by the contacts.

17. An assembly comprising:
a reed relay switch;
a high-potential circuit for providing magnetic flux for operating the reed relay switch;
said high potential circuit including a high-voltage bus bar;
a bus bar seat for attaching the switch to the bus bar;
said seat extending beyond the reed relay switch along the bus bar; and
said seat including a flat portion with a conductive coating between the seat and the bus bar to provide a shield decoupling the high voltage from the reed relay switch.

18. The assembly of claim 17 including a threaded nut for attaching the reed relay switch to the bus bar seat;

internal threads on the portion of the seat for receiving the threaded nut and clamping the reed relay switch to the bus bar seat; and

said threaded nut produced from a dielectric material.

19. The assembly of either of claims 17 or 18, wherein said seat includes an attaching arrangement for attaching the seat to the bus bar, said attaching arrangement including a clamping arrangement for forcing the conductively coated portion of the seat against the bus bar.

20. The reed relay switch assembly of claim 19 wherein the clamping arrangement comprises:

said seat having oppositely disposed legs that extend beyond said bus bar;

a slot located in each of said legs, said slots distanced from the conductively coated portion of the seat;

a non-ferrous plate inserted into said slots; a

threaded hole in said plate; and

a threaded fastener threaded into the threaded hole to force the conductively coated portion of the seat against the bus bar.

21. A switching assembly comprising:

a reed relay switch;

a high-potential flux source providing magnetic flux for operating the reed relay switch;

said reed relay switch and said flux source being movable relative to one another to control the reed relay switch sensitivity; and

electrostatic shielding material located between the flux source and the reed relay switch to galvanically decouple the reed relay switch from high voltage.

22. The switching assembly of claim 21 wherein said shielding material includes:

a spacer element between the magnetic flux source and the reed relay switch;

said reed relay switch being attached to said spacer element to move together within the assembly to vary the sensitivity of said reed relay switch;

the surface of the spacer element juxtaposed to a surface of said reed relay switch assembly; and

at least one of said surfaces being coated with a non-ferromagnetic conducting material.

23. The reed relay switch assembly of claims 21 or 22 wherein the movement for varying the reed relay switch sensitivity is rotational.

24. A reed relay switch assembly comprising:

a reed relay switch having contacts operated by magnetic flux; a

high-voltage source of magnetic flux; and wherein

said reed relay switch is enclosed in a non-ferromagnetic conductive material.

25. The reed relay switch assembly of claim 24 wherein the source of magnetic flux is encased in the non-ferromagnetic conductive material.

26. The reed relay switch assembly of claims 24 or 25 including an electrostatic separation between the source of magnetic flux and the reed relay switch.

27. The reed relay switch assembly of claim 26 wherein the electrostatic separation includes a conducting element between the source of magnetic flux and the reed relay switch.

28. The reed relay switch assembly of claim 27 wherein said conducting element is non-ferrous.

29. A reed relay switch assembly comprising:

a bus bar at high voltage providing magnetic flux;

a reed relay switch operable by said magnetic flux; and

circuitry for indicating a presence of said high voltage.

30. The reed relay switch assembly of claim 29 including:

an antenna arranged to detect said high voltage and provide received signals;

an amplifier coupled to the antenna to amplify the received signals; and

an indicating device operated responsive to the amplified signals to indicate the presence of the high voltage.

31. The reed relay switch assembly of claim 29 or 30 wherein said antenna comprises a conducting filler surrounding the reed relay switch.

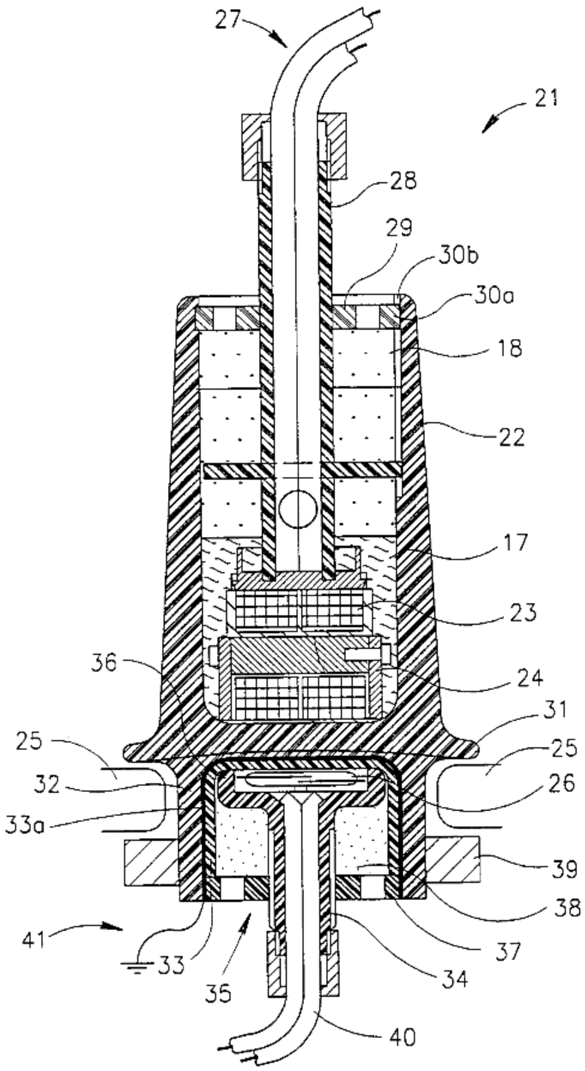

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FIG.1

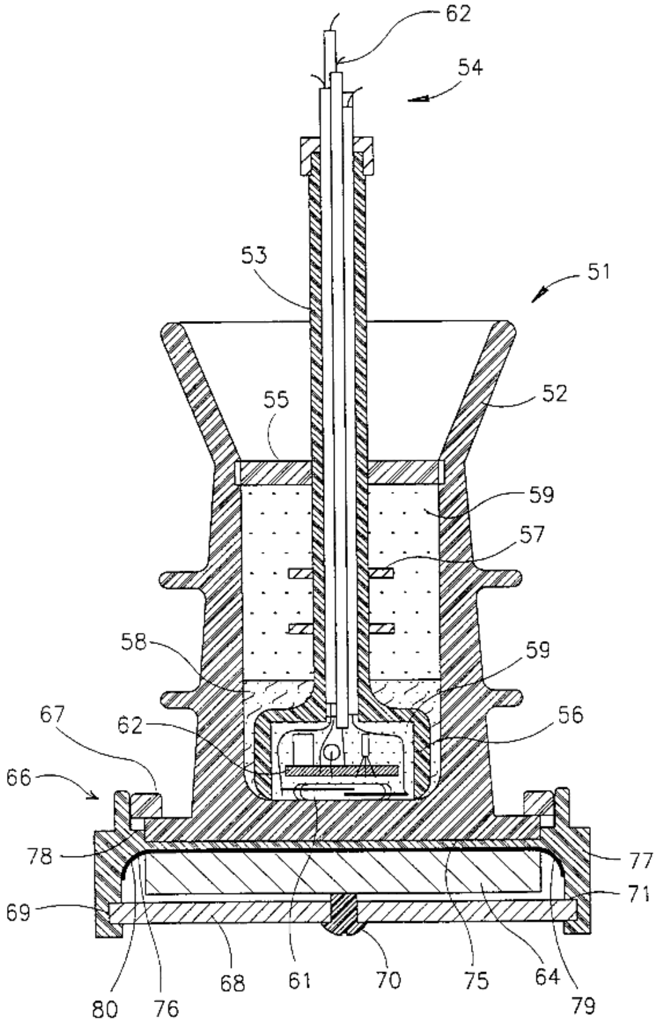
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FIG.2

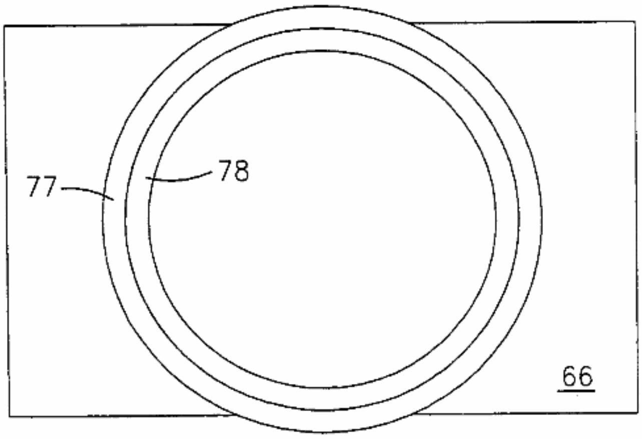

FIG.3

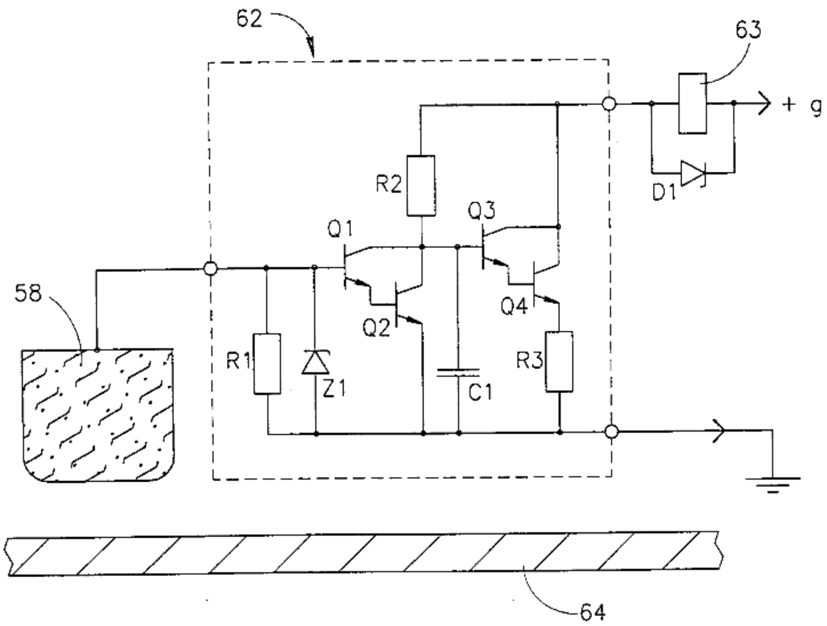

FIG. 4