

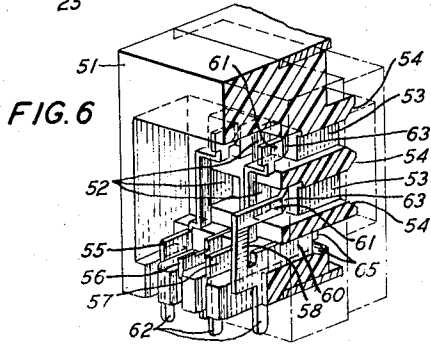
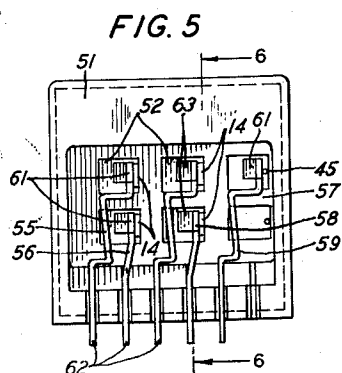
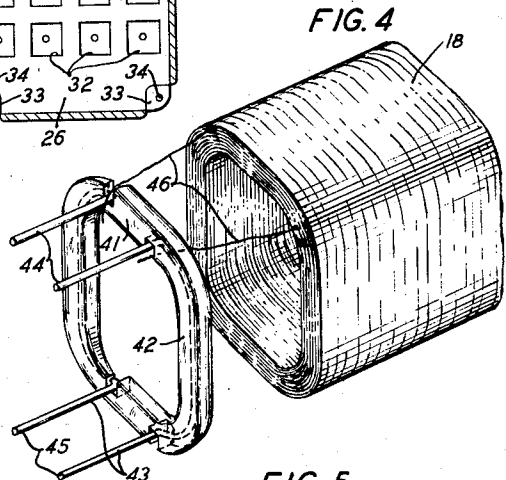
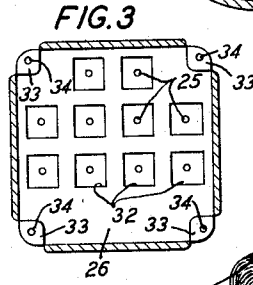
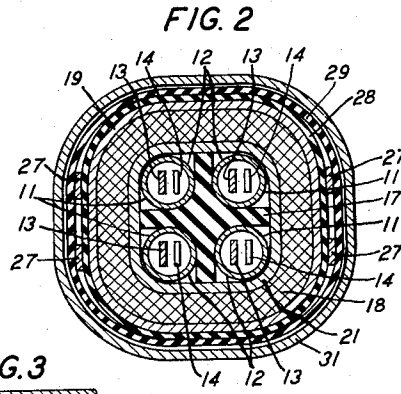
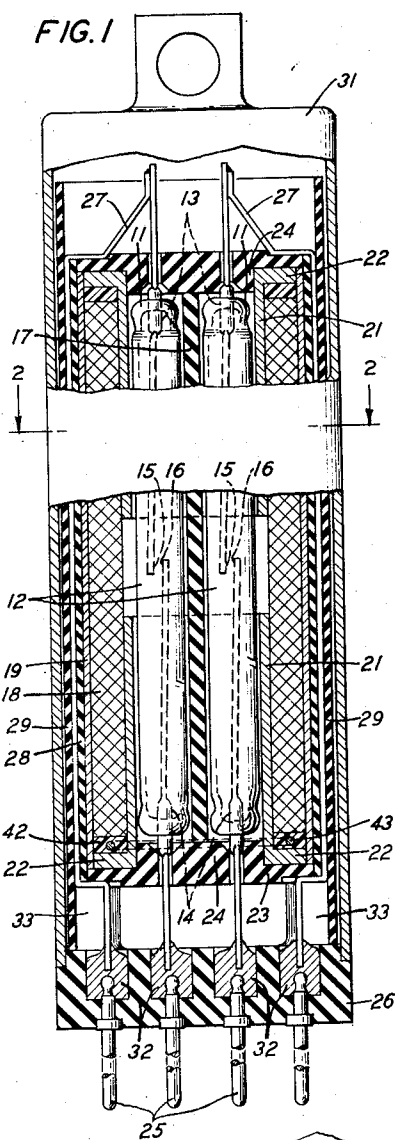
June 2, 1959

R. F. GLORE ET AL

2,889,424

RELAY

Filed Dec. 31, 1957



R. F. GLORE
O. M. HOVGGAARD
G. E. PERREAULT
INVENTORS
BY
Walter M. Hill
ATTORNEY

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2,889,424

RELAY

Robert F. Glore, Scotch Plains, and Ole M. Hovgaard, Berkeley Heights, N.J., and George E. Perreault, White Plains, N.Y., assignors to Bell Telephone Laboratories, Incorporated, New York, N.Y., a corporation of New York

Application December 31, 1957, Serial No. 706,397

7 Claims. (Cl. 200—87)

This invention relates to relays, and more particularly to relays employing dry reed contacts within a hermetically sealed envelope.

There has been developed a hermetically sealed reed contact device which acts as the contact means for a relay. This reed device is generally placed axially within the energizing coil of the relay where it becomes extremely rapid in action and very sensitive. Such device is disclosed in Patent 2,289,830, granted to W. B. Ellwood, July 14, 1942; and, it has been employed in numerous combinations, one of which showing sequential operation of a plurality of such contact devices is set forth in Patent 2,243,399, granted to A. M. Skellett, May 24, 1941.

The hermetically sealed reed contact device is of relatively simple construction consisting essentially of two reeds which are mounted at opposite ends of an elongated glass envelope. In addition to protecting the reed contacts from dirt and the like, this construction results in extremely low unit cost and this, in turn, accounts in large measure for the extensive use that has been accorded the device.

It is the object of this invention to increase the durability and reliability of relays employing dry reed contact devices.

A further object is to simplify the manufacturing and thereby reduce the cost of such relays.

These and other objects are attained in accordance with the present invention wherein a plurality of glass-sealed reed contact devices are arranged coextensively in a group and a common coil surrounds the same and serves to simultaneously energize the reeds to control electrical circuits. A flux-carrying metallic casing substantially surrounds the coil, with the exception of that portion of the latter most adjacent the switch gaps of the reed devices. Thus, the coil flux is directed to, and concentrated at, the switch gaps.

An added feature of the invention is in the provision of a base having polygonal shaped solder-receiving wells therein which facilitate fabrication. With the outlet terminals each projecting into a well, solder pellets are placed in each well and after the application of sufficient heat to melt the solder, the assembled group of reed devices is mounted on the base with the various terminals of the group simultaneously projected into respective wells. The use of polygonal shaped wells, e.g., square or rectangular, permits the gas generated by the flux during heating to escape. That is, the corners in effect act as vents allowing the escape of gas.

A further feature of the invention comprises the use of a terminal assembly, mounted on the coil, for indirectly connecting the coil to outlet terminals secured in the base. The coil is electrically connected to the terminal assembly at one end thereof, while the assembly is connected to the outlet terminals at the opposite end. The terminal assembly is capable of some transverse flexing and thus relative movement between the coil and

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base will tend to flex the terminal assembly rather than subject the coil wires to a strain as was the case heretofore when the coil wires were connected directly to the outlet terminals.

Other objects and features and many of the attendant advantages of the invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which:

Fig. 1 is an enlarged elevational view, partially in cross section, of a relay constructed in accordance with the present invention;

Fig. 2 is an enlarged view taken on the line 2—2 of Fig. 1;

Fig. 3 is a top view, in reduced scale, of the base shown in cross section in Fig. 1;

Fig. 4 is a fragmentary perspective view of the coil and the terminal assembly which indirectly connects the coil to outlet terminals;

Fig. 5 is an end elevational view of a modified base which can be used to mount the relay on a printed circuit board; and

Fig. 6 is a perspective view taken on the line 6—6 of Fig. 5.

Referring now to the drawings, and particularly to Figs. 1 and 2, four glass-sealed reed contact devices 11 are shown grouped together. The switch contacts of each reed device are enclosed in a hermetically sealed, tubular envelope 12 made of a vitreous material such as glass. An inert gas such as helium, argon, neon, or any other non-corrosive gas, may be inserted in this enclosure for the purpose of reducing arcing across the contact gap, but this is in no way essential for successful operation of the relay of the present invention. Inserted and sealed in each envelope at either end thereof are contact reeds 13 and 14 having overlapping contact areas 15 and 16, respectively. These contact reeds may be formed of any suitable magnetic material of high electrical conductivity. As shown more clearly in Fig. 2, the contact reeds 13 and 14 are made from a flat member, but it will be readily appreciated that round contact members or members of other cross sectional configuration may be substituted for the reeds 13 and 14 without departing from the spirit and scope of the invention. Contact areas 15 and 16 may be plated with gold or other precious metal to improve the overall operating characteristics of the device.

The four reed devices 11 are coextensive and spaced from each other by means of an insulating spacer 17. A common coil 18 surrounds the group of reed devices and serves to simultaneously energize the reeds to control electrical circuits. A metallic casing 19 of magnetic material having low reluctance surrounds the outer surface of the coil 18. A pair of tube-like metallic members 21, of magnetic material of low reluctance, project into the interior of the wrapped coil a predetermined distance from the opposite ends thereof. Each member 21 has an integral end flange 22 which abuts an end of the coil assembly and contacts, along its periphery, the casing 19. With the exception of that portion most adjacent the switch gaps of the reeds, the coil is thus surrounded by a flux-carrying metallic casing. The casing, being of low reluctance, prevents the loss of flux through other undesired paths and hence substantially all the coil flux is directed to, and concentrated at, the switch gaps.

With the switch contacts open, the coil flux can be assumed to travel to the reeds 13 from the upper metallic member 21, then down along the reeds 13 to the switch gaps, across the gaps to reeds 14, along reeds 14 a short distance, and then back across the air gap to the lower member 21. Thus, it will be noted that the coil flux sees initially three short air gaps in the desired path.

The metallic members 21 should not be spaced so close together as to present a flux path, through the air, of lower reluctance than the desired path. To this end the members 21 are spaced apart a distance which is approximately twice that of the total distance of the above-noted three short air gaps.

Insulator end blocks 23 are positioned, at the ends of the coil and switch group, in abutment with the flange 22. The blocks 23 are provided with portions 24 which are inserted into the interior of the tube-like members 21, forming a fit therewith. Thus, axial displacement of the reed devices 11 is prevented and the devices 11 and coil 18 are positioned together as a group for the soldering operation. The reeds 14 are mass soldered directly to the outlet terminals 25 in the base 26 in a manner to be described, while the reeds 13 are mass soldered to the conductors 27 which are brought down along the sides of the casing 19 and soldered to respective outlet terminals. Insulating material 28 is disposed between the casing 19 and conductors 27. As shown in Fig. 1, each conductor 27 bears against the upper and lower end blocks 23 to prevent them from becoming dislodged. With the reeds and coil connected to the outlet terminals, a thin tube of insulating material 29 is slipped over the entire assembly and the outer metallic casing 31 is mounted on the base by a simple crimping operation.

The relay base, shown in Figs. 1 and 3, constitutes a feature of the invention which facilitates fabrication. The base 26 comprises a plurality of polygonal shaped solder-receiving wells 32. In the illustrated case, the wells are square in shape and ten in number (two for each reed device and two for the coil). It should be noted, however, that other well configurations, such as triangular or rectangular, would be equally satisfactory. With an outlet terminal 25 projecting into each well as shown, solder pellets are placed in each well and the base is then subjected to sufficient heat to melt the solder. The base may be formed of any insulating material, such as a phenolic molding compound, which possesses a substantially higher melting point than that of solder. The assembled group comprising the coil and reed devices is then mounted on the corner supports 33 of the base, the supports being provided with small knobs 34 which are received in corner recesses (not shown) in the lower end block 23. When so mounted, the various coil and reed terminals will each be projected into a respective well. Upon cooling, a strong, sturdy structure is provided.

A solder pellet when heated will, of course, spread out radially, but due to surface tension it will retain a round configuration. With such a pellet disposed in a round well or hole, the application of heat causes the solder to spread to and contact the walls of the well. This, however, prevents the gas generated by the flux during heating to escape with the result that the solder will be pushed up and out of the well by the gas. It has been found that this can be overcome through the use of polygonal shaped wells. The heated solder still spreads out and contacts the side walls of the well, but because it tends to retain a round shape it will not spread or fill into the corners of the well. Thus, an effective air vent is provided adjacent each corner permitting the escape of the generated gas.

Before considering the next feature, it should be noted that it has been the practice heretofore to electrically connect the coil into the relay unit by soldering the coil ends directly to the outlet terminals. This type of fabrication, while relatively simple, has not been entirely satisfactory for as the coil unit begins to contract in length with the passage of time, the thin wires comprising the coil ends are subjected to an ever increasing tension and if the shrinkage is great enough, the coil wires eventually snap or break. Leaving slack in the coil ends has been tried, but this also has not been too satisfactory. The slackened wires are more readily broken in

assembly and they snap more easily when subjected to vibration or shock.

In Fig. 4 there is shown a coil unit and a terminal assembly for the same in accordance with the present invention. The coil unit 18 comprises a large number of turns of very thin wires encased in an insulation such as cellulose acetate. The insulation must be used to protect the coil wires from corrosion and the like, but it is the insulation that is primarily responsible for the contraction in length of the coil unit.

Terminal assembly 41 includes an element 42 of insulating material, such as cellulose acetate, having the same cross sectional configuration as the coil unit. A pair of wires 43 includes a first pair of upstanding portions 44 at one end or side of the element 42 and a second pair of upstanding portions 45 at the other end of the element. The upstanding portions of each wire are integrally connected by an intermediate section of wire embedded in the insulating element 42. The coil ends 46 are wrapped around and soldered to the base of portions 44 and then the remainder of the latter is cut off, while the portions 45 of the wires are soldered directly to a pair of outlet terminals. Time is saved in fabrication by making the terminal assembly symmetrical and then cutting off the unused upstanding portions, rather than making an unsymmetrical assembly (one short and one long pair of upstanding portions) and then orienting it to the correct position for connection with the coil. The terminal assembly 41 is preferably cemented to the end of the coil unit.

It will be noted first that the wires 43 are of much greater diameter than the coil wire and thus they can withstand substantially more stress and strain without snapping. Further, the terminal assembly is capable of flexing transversely. With the terminal assembly cemented to the coil unit, any attempted movement of the latter away from the base, due to coil shrinkage or otherwise, will tension the portions 45 of the interconnecting wires. The heavy wires 43 can withstand relatively high stresses and hence, in most cases, movement of this side or end of the coil will be arrested. However, inasmuch as the opposite side of the terminal assembly and coil are free of the base, they can move or shift position with respect thereto. Such movement will transversely flex the terminal assembly, but this is not detrimental for electrical interconnection of the coil and outlet terminals is still maintained. Under considerable stress that portion of the terminal assembly adjoining the upright portions 45 may separate from the coil unit. In this instance, the entire coil will move away from the base, but here again the only effect will be a transverse flexing of the assembly 41.

In Figs. 5 and 6 there is shown a modified base which can be used to mount the relay unit on a printed circuit board. In this embodiment, identical bases are mounted at both ends of the relay and the reeds 13 and 14 are brought out to the bases at their respective ends. Likewise, a terminal assembly is provided at each end of the coil. Each terminal assembly is similar to that of Fig. 4, except that only a single interconnecting wire is needed at each end. The base 51, formed of an insulating material, comprises a plurality of polygonal shaped solder-receiving wells 52. Small passageways 53 interconnect at one end with the wells 52 and are flared at the other end 54. The passageways 53 are adapted to receive the ends of the reeds or the interconnecting wire of the terminal assembly, as the case may be. Each passageway is designed to closely fit the element to be received and hence the flared ends 54 aid in inserting the elements into the passageways.

Spring-like terminals 55, 56, 57, 58, and 59 are provided with portions 61, which project into respective wells, and staggered end extremities 62, which are received on the printed circuit board. The portions 61, disposed in the wells, have outwardly bent extremities 63 for guiding the elements which are inserted into the pas-

sageways. By way of example, assume in Fig. 6 that a reed is inserted into one of the close fitting passageways 53. As the reed is pushed along the passageway it enters into a well in the base and then contacts a bent extremity 63. The extremity directs the reed to a position between the portion 61 of the terminal and the adjoining side wall of the well. The terminal being resilient is displaced slightly from its original position and hence it bears against the reed to form a contact therewith preparatory to the soldering operation. If the extremity 63 were not bent as shown, the inserted reed would occasionally abut the end of the terminal preventing its projection into the well.

The terminals 55, 57, and 59, which project into the top row of wells 52, each comprise a number of right angularly disposed sections such as shown by terminal 55 in Fig. 6. The terminals 56 and 58 which project into the bottom row of wells 52 also comprise a number of right angularly disposed sections, but they are necessarily of a different configuration than the first-mentioned terminals. These latter terminals are illustrated at 58 in Fig. 6. A portion of terminal 56 has been broken away in Fig. 6 to show more clearly the terminal 55; and the reeds 14, shown inserted into the wells in Fig. 5, have been omitted in Fig. 6. As illustrated by terminal 58 in Fig. 6, each of the terminals is provided with an inwardly extending portion 60 which projects through the base to the opposite side thereof. Tabs 65 are provided at the end of the inwardly extending portion 60, and they are bent at right angles to bear against the adjacent flat surface of the base for holding the terminals to the base.

With this type base, fabrication can be carried out in one of two ways. First, with the reeds and interconnecting wire of the terminal assembly projected into respective wells in a base, solder pellets can be placed in each well and then heated. This, of course, is similar to the fabrication of the relay of Fig. 1. The passageways 53 fit sufficiently close about the inserted elements as to prevent the loss of solder therethrough. Alternatively, with the inserted relay elements in spring contact with the outlet terminals a thin stream of molten solder can be directed at each interface to form a good electrical connection therebetween. With this alternative method of fabrication, the passageways 53 need not fit closely about the inserted elements.

While the drawings illustrate a relay unit comprising four reed switching devices, it will be obvious that the features of the invention are not so limited. The relay may comprise any number of reed devices, and relay units with sixteen or more of such devices are not uncommon.

Accordingly, it is to be understood that the above-described arrangements are merely illustrative of the application of the principles of the invention. Numerous other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. A relay comprising a plurality of reed contact switching devices arranged coextensively in a group, a common energizing coil surrounding said group, a flux-carrying metallic casing of low reluctance surrounding said coil except for that portion of the latter most adjacent to the switch gaps of the switching devices, a base of insulating material having polygonal shaped solder-receiving wells therein, outlet terminal means mounted in said base and projecting into said solder-receiving wells, said coil and switching devices being electrically interconnected to said outlet terminal means by solder pellets disposed in said solder-receiving wells, and a terminal assembly mounted on the end of said coil most adjacent said base for electrically interconnecting the coil to outlet terminal means in said base, said coil being electrically connected to the terminal assembly

at one of the ends thereof while said assembly is electrically connected to said outlet terminal means at the opposite end, said terminal assembly having a length between said ends which is substantially greater than its thickness and which lies in a plane substantially parallel with the end of said coil.

2. A relay comprising a plurality of reed switching devices arranged coextensively in a group, each of said switching devices comprising a tubular envelope and a pair of contact reeds mounted at respective ends of said envelope and extending longitudinally thereof so as to present overlapping contact areas, a common energizing coil surrounding said group, a flux-carrying metallic casing of low reluctance surrounding said coil except for that portion of the latter most adjacent the switch gaps of the switching devices, a base of insulating material having a plurality of polygonal shaped solder-receiving wells therein, a plurality of outlet terminals mounted in said base and projecting into respective wells in said base, said coil and switching devices being electrically interconnected to respective outlet terminals by solder pellets disposed in said wells, the insulating material of said base having a substantially higher melting point than that of the solder, and a terminal assembly mounted on the end of said coil most adjacent said base for electrically interconnecting the coil to outlet terminals in said base, said coil being electrically connected to the terminal assembly at one of the ends thereof while said assembly is electrically connected to said outlet terminals at the opposite end, said terminal assembly having a length between said ends which is substantially greater than its thickness and which lies in a plane substantially parallel with the end of said coil.

3. A relay comprising a plurality of reed switching devices arranged coextensively in a group, each of said switching devices comprising a tubular envelope and a pair of contact reeds mounted at respective ends of said envelope and extending longitudinally thereof so as to present overlapping contact areas, a common energizing coil surrounding said group, a first metallic casing of low reluctance encompassing the outer surface of said coil, and a pair of low reluctance metallic casings of tube-like configuration mounted at respective ends of said coil, each of said pair of casings extending coaxially into the interior of said coil to a point adjacent the switch gaps of the switching devices, said pair of casings having end flanges overlying the ends of said coil.

4. A relay comprising reed contact switching means, an energizing coil surrounding said switching means, a base having outlet means mounted therein, and a terminal assembly mounted on the end of said coil most adjacent said base for electrically interconnecting the coil to outlet means in said base, said coil being electrically connected to the terminal assembly at one of the ends thereof while said assembly is connected to said outlet means at the opposite end, said terminal assembly having a length between said ends which is substantially greater than its thickness and which lies in a plane substantially parallel with the end of said coil.

5. A relay as defined in claim 4 wherein said terminal assembly is electrically connected to said outlet means by wire of a diameter substantially greater than that of the wire of said coil.

6. In combination, a plurality of reed contact switching means, an energizing coil surrounding said switching means, a base of insulating material having polygonal shaped solder-receiving wells therein, outlet terminal means mounted in said base and projecting into said solder-receiving wells, said coil and switching means being electrically interconnected to said outlet terminal means by solder pellets disposed in said solder-receiving wells, and a terminal assembly mounted on the end of said coil most adjacent said base for electrically interconnecting the coil to outlet terminal means in said base, said coil being electrically connected to the terminal as-

sembly at one of the ends thereof while said assembly is electrically connected to said outlet terminal means at the opposite end, said terminal assembly having a length between said ends which is substantially greater than its thickness and which lies in a plane substantially parallel with the end of said coil.

7. In combination, a plurality of reed switching devices arranged in a group, each of said switching devices comprising a tubular envelope and a pair of contact reeds mounted at respective ends of said envelope and extending longitudinally thereof so as to present overlapping contact areas, a common energizing coil surrounding said group, a base of insulating material having a plurality of polygonal shaped solder-receiving wells therein, a plurality of outlet terminals mounted in said base and projecting into respective wells in said base, said coil and switching devices being electrically interconnected to respective outlet terminals by solder pellets disposed in said wells, the insulating material of said base having

a substantially higher melting point than that of the solder, and a terminal assembly mounted on the end of said coil most adjacent said base for electrically interconnecting the coil to outlet terminals in said base, said coil being electrically connected to the terminal assembly at one of the ends thereof while said assembly is electrically connected to said outlet terminals at the opposite end, said terminal assembly having a length between said ends which is substantially greater than its thickness and which lies in a plane substantially parallel with the end of said coil.

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