

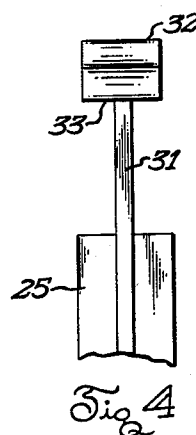
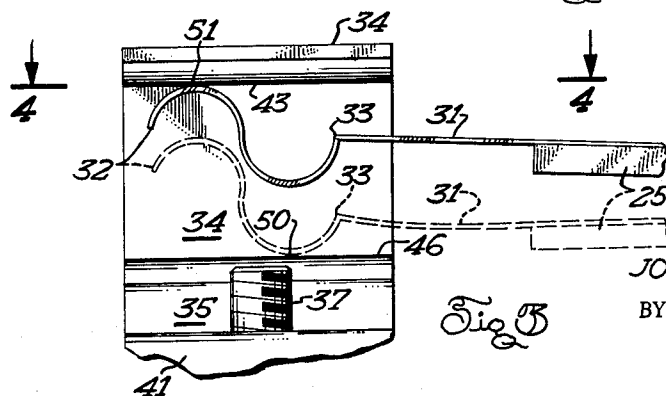
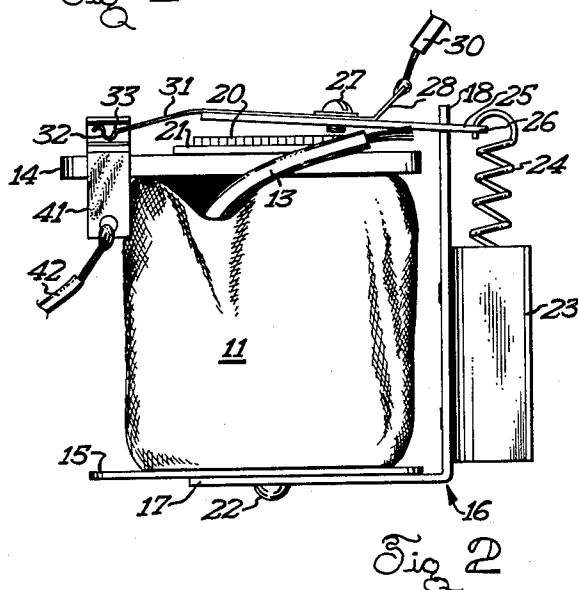
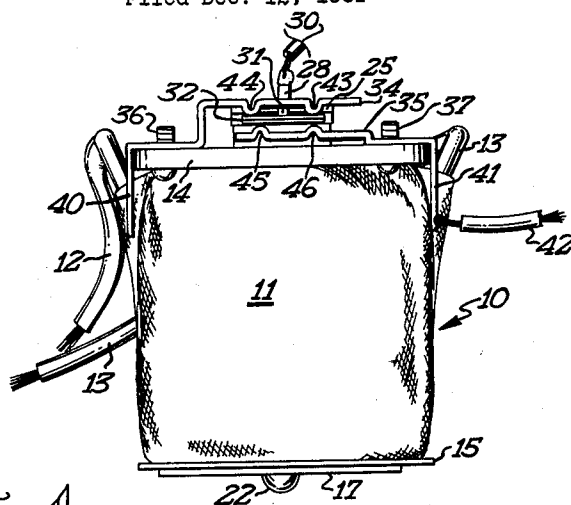
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RELAY WITH IMPROVED ELECTRICAL CONTACT STRUCTURE

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RELAY WITH IMPROVED ELECTRICAL CONTACT STRUCTURE

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The present invention is directed to a contact structure of a reliable nature, and more particularly is directed to a redundant contact arrangement wherein a wiping action occurs whenever the contact surfaces meet in order to provide reliable electrical circuit control at low voltages.

In switching electrical voltage of a low level, it is very important that the contact surfaces involved be kept clean and free of matter that might prevent good electrical contact. Since in switching low voltages, the voltage itself is not adequate to arc through small surface films or dirt, it is necessary to provide some means of self-cleaning the contact surfaces at each operation of the contact device. This is normally accomplished by providing some type of wiping action between the two contact surfaces as they meet. Obtaining a wiping action normally requires quite critical control over the contact members and requires delicate adjustment of the position of the contact units. In order to improve the reliability of switching the devices for low voltage it has become quite common to use redundant contact arrangements in the form of wire brushes for one or more of the contact members. This arrangement is quite complex and costly compared to the very simplified approach disclosed in the present invention.

In the present invention a contact structure is disclosed that is particularly adapted for use with electro-magnetic clapper type relays. The present contact structure has two surfaces which are free to mate with one another and which are given a wiping action by over-travel of the relay armature with respect to one of the contact members. The over-travel creates a rotation between the two mating electrical surfaces thereby creating a wiping action. In addition to the wiping action created in the present device, the two mating surfaces have two separate contact points so that redundant operation is available. This guarantees a reliable contact action when low voltages are switched.

It is a primary object of the present invention to disclose a contact structure that is particularly adapted to be used with a clapper type of relay and which provides both redundant contact surfaces and a cleaning or wiping action.

Another object of the present invention is to disclose a very reliable contact structure that is useable with a relay and which is simple and inexpensive to manufacture.

Yet another object of the present invention is to disclose a contact structure that can be adapted for use with any type of motive means that provides a pivoted moving member for carrying one of the contact members.

These and other objects will become apparent when the present drawing is considered with the specification.

In the drawings, FIGURE 1 is an end view of a relay incorporating the contact structure of the present invention;

FIGURE 2 is a side elevation of FIGURE 1;

FIGURE 3 is an enlarged elevation of just the contact section of the unit as disclosed in FIGURE 2, and

FIGURE 4 is a top view of the movable contact taken along line 4—4 of FIGURE 3.

In FIGURE 1 there is a relay generally disclosed at 10 having a coil 11 which is energized through two conductors 12 and 13. The coil 11 is supported on an insulated bobbin having flanges 14 and 15. The coil, bob-

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bin and flanges are all conventional and in turn are supported on a magnetic frame means 16 having a bottom 17 and an upright member 18. The coil 11 has a laminated magnetic center core 20 which is partially encircled by the conventional shading ring 21 and the core 20 and ring 21 are held by rivet means 22 to the frame means 16. A bracket 23 is provided on the upright frame 18 as a mounting means for the relay and also as a means of anchoring one end of a spring 24. Spring 24 is a conventional tail spring of the relay and is connected to an armature 25 at a point 26. The relay device disclosed thus far is a more or less conventional clapper type of relay wherein an armature is pivoted on a frame means and the armature is moved between a first and a second position by energizing the coil 11 of the relay.

Attached to the armature 25 by a screw 27 is a terminal 28 and conductor 30. The terminal 28 in turn is connected to a forward conductor portion or support means 31 that forms part of the suspension for the movable contact in the present invention. The forward support means 31 is a thin, narrow electrical conductor that is quite resilient and forms a cantilever suspension of an S-shaped contact 32. The S-shaped contact 32 is formed of a good electrical conducting material or can be formed out of the material which the cantilever support means 31 is formed out of with an overlay of a good electrical conducting material. The fabricating technique for the S-shaped contact 32 is conventional and forms no part of the present invention. It will be noted that the S-shaped contact 32 is joined at 33 to the cantilever support means 31 and that the S-shaped contact 32 is therefore free to be flexed in an up and down direction, as well as, capable of being rotated about an axis along the thin flexible cantilever member 31. This gives the S-shaped contact 32 freedom of movement in two planes. The reason for this particular arrangement will be brought out in detail below.

Two fixed contact members 34 and 35 are supported by screws 36 and 37 from the flange 14 of the bobbin that supports the coil 11. Each of the contacts 34 and 35 is electrically isolated from the other and from any other part of the device. Contact 34 has a projection 40, while contact 35 has a projection 41, and these projections are conveniently used as electrical connectors for the contacts. As shown, a conductor 42 is connected to projection 41 to provide a circuit to the contact member 35. A similar connection is made to projection 40 so that an electrical circuit can be completed either between the projection 40 and the S-shaped contact 32 or between the projection 41 and the S-shaped contact 32 depending upon whether the relay is in a first or a second position.

It will be noted that each of the contacts 34 and 35 has raised contact surfaces 43, 44, 45, and 46. The raised contact surfaces 43 through 46 are embossed ridges in the flat contact members 34 and 35. The embossed or raised portion forms a contact surface of a raised nature which can be readily struck by the outer surfaces of the S-shaped contact 32. Enlarged views of the contact arrangement can be seen in FIGURES 3 and 4, wherein the armature 25 is shown in its uppermost position and again in phantom in its lowermost position. The armature 25 carries a cantilever support means 31 which is attached to the S-shaped contact 32. In the upper position shown in FIGURE 3, the S-shaped contact 32 is against the raised portion 43 and the raised portion 44 of the upper contact 34. Due to the over-travel of the armature 25 in an upward direction, the S-shaped contact 32 strikes the upper contact 34 and then rocks slightly to perform a wiping action against the rounded surfaces of 43 and 44. As will be noted when the armature 25 is in the downward posi-

tion shown in phantom in FIGURE 3, the S-shaped contact 32 is rocked backwards or clockwise. It is thus apparent that at the contact point 50, that the S-shaped contact 32 has come in contact with the raised portion 46 and then has been rocked by the over-travel of the armature 25 thereby providing a wiping action when the contact 32 is moved in a downward direction.

It is thus apparent that whenever the S-shaped contact 32 is allowed to touch the upper contacts 34 and is allowed over-travel, a rocking motion to wipe the contacts clean is provided. Since the contact 32 is allowed to rotate in two planes, the contact 32 strikes the contact member 34 at 51 and rocks against the two raised portions 43 and 44 thereby providing a redundant contact arrangement before the wiping action is completed. This same action occurs when the relay contact 32 is pulled downward by the energization of the relay 10 thereby again providing redundant contacts between the S-shaped contact 32 and the lower raised portions 45 and 46 prior to the rocking action that cleans the surfaces between the mating parts.

It is apparent that a relay has been disclosed that has a contact structure that provides two essential functions for low voltage switching. First, there is a redundant contact structure, and secondly, there is a wiping action provided by the relative movement of the contact members of the device. With this arrangement a highly reliable contact arrangement is provided that can be used for controlling exceedingly small voltages and currents. It should be noted that while the contact structure has been specifically disclosed as operating on a clapper type of relay, it would be possible to utilize this contact structure on any type of a motive means that provides a rocking or pivoted motion so that the necessary two freedoms of motion of the contacts are provided. As such, it is believed that it would be apparent to one skilled in the art to apply the present contact structure to other types of relays and motive means and the applicant does not wish to be limited solely to a clapper type of relay. It is further noted that many variations in this simple contact structure would be possible and therefore only a preferred embodiment has been shown. The applicant believes that with many possible modifications that the present invention should be limited only by the scope of the appended claims.

I claim as my invention:

1. A relay having an electrical contact structure, including: an armature pivotally mounted upon a relay member and movable between a first and a second position; coil means energizable to move said armature between said two positions; a first and a second fixed contact member supported on said relay with each being generally parallel to each other and electrically insulated from each other; each said contact member having a plurality of raised contact surfaces; a movable contact member including support means supported on said armature and moved between said fixed contacts upon movement of said armature between said first and said second position; and said movable contact member being S-shaped in cross section and supported by said support means from said armature in a cantilever manner that allows said movable contact member to have freedom of motion in two planes; opposite surfaces of said S-shaped contact striking the fixed contact surfaces; said support means allowing said S-shaped contact to rotate in each plane of freedom to provide a wiping action when the movable contact member touches either fixed contact and to rotate to contact at least two of said raised surfaces before said armature reaches its first or its second position.

2. A relay having an electrical contact structure, including: an armature pivotally mounted upon a relay member and movable between a first and a second position; coil means energizable to move said armature between said two positions; a first and a second fixed contact

member supported on said relay with each being generally parallel to each other and electrically insulated from each other; each said contact member having at least one raised contact surface; a movable contact member including support means supported on said armature and moved between said fixed contacts upon movement of said armature between said first and said second position; and said movable contact member being S-shaped in cross section and supported by said support means from said armature in a cantilever manner that allows said movable contact member to have freedom of motion in two planes; opposite surfaces of said S-shaped contact striking the fixed contact surfaces; said support means allowing said S-shaped contact to rotate in each plane of freedom to provide a wiping action when the movable contact member touches either fixed contact before said armature reaches its first or its second position.

3. Relay means having contact structure means, including: armature means pivotally mounted upon said relay means and movable between a first and a second position; coil means energizable to move said armature means between said two positions; first and second fixed contact means supported on said relay means and electrically insulated from each other; each said fixed contact means having a plurality of raised contact surfaces; movable contact means including support means supported on said armature means and moved between said fixed contact means upon movement of said armature means between said first and said second position; and said movable contact means being S-shaped in cross section and supported by said support means from said armature means in a cantilever manner that allows said movable contact means to have freedom of motion in two planes; opposite surfaces of said S-shaped contact means striking the fixed contact surfaces; said support means allowing said S-shaped contact means to rotate in each plane of freedom to provide a wiping action when the movable contact means touches either fixed contact means and to rotate to contact at least two of said raised surfaces before said armature means reaches its first or its second position.

4. Relay means having contact structure means, including: armature means pivotally mounted upon said relay means and movable between a first and a second position; coil means energizable to move said armature means between said two positions; first and second fixed contact means supported on said relay means and electrically insulated from each other; each said fixed contact means having at least one raised contact surface; movable contact means including support means supported on said armature means and moved between said fixed contact means upon movement of said armature means between said first and said second position; and said movable contact means being generally S-shaped in cross section and supported by said support means from said armature means in a cantilever manner that allows said movable contact means to have freedom of motion in two planes; opposite surfaces of said S-shaped contact means striking the raised contact surfaces; said contact support means allowing said S-shaped contact means to rotate in each plane of freedom to provide a wiping action when the movable contact means touches either fixed contact means before said armature means reaches its first or its second position.

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