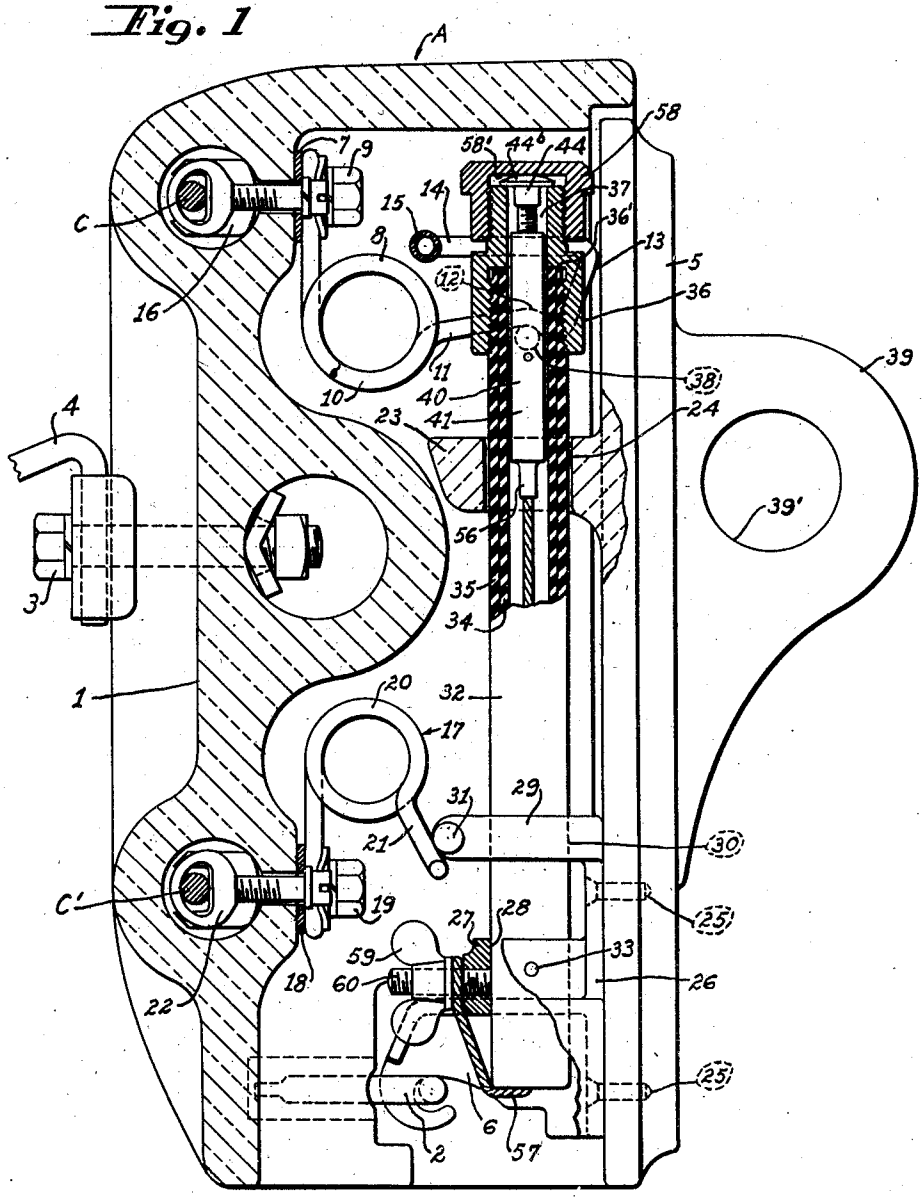
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GAP LINK

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Fig. 1



INVENTOR
GEORGE W. GOLDNER
BY Emmarrington
ATTORNEY

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Fig. 2

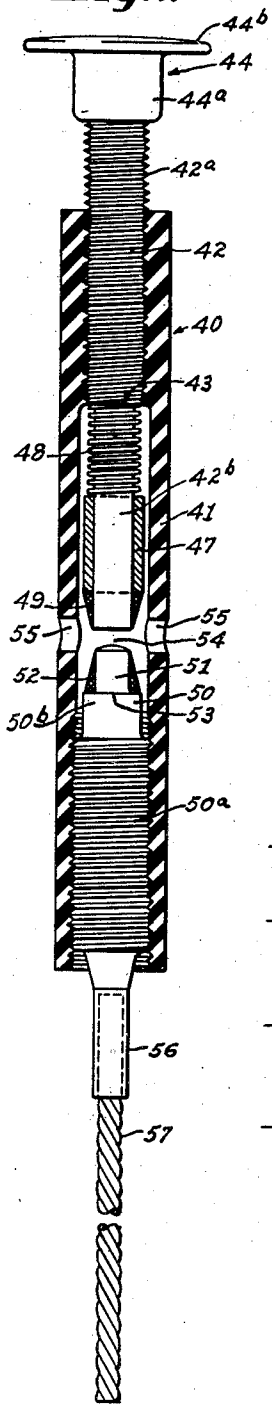


Fig. 3

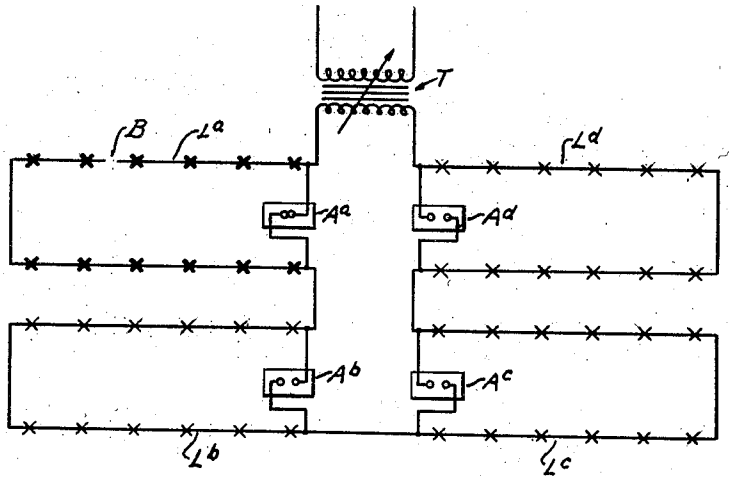
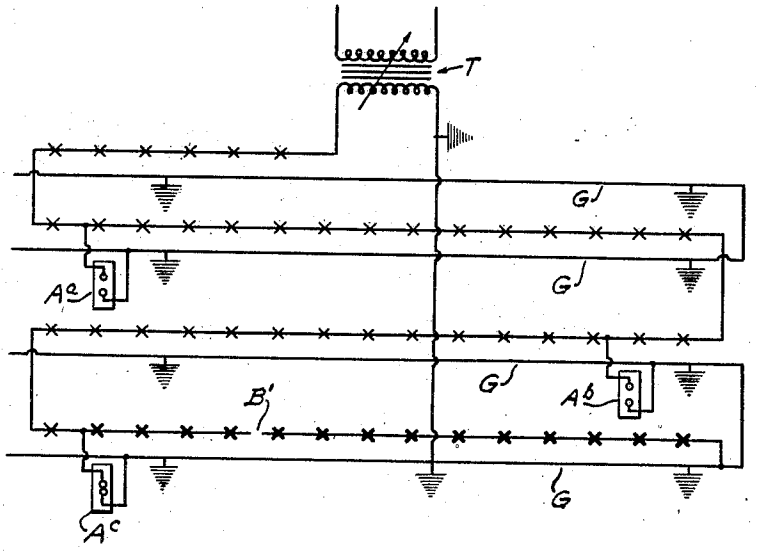


Fig. 4



INVENTOR
GEORGE W. GOLDNER
BY Ellis Harrington
ATTORNEY

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2,277,222

GAP LINK

George W. Goldner, St. Louis, Mo., assignor to James R. Kearney Corporation, St. Louis, Mo., a corporation of Missouri

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6 Claims. (Cl. 200—118)

This invention relates generally to series cutouts of the type adapted particularly for use with series street lighting circuits, and more specifically to gap links adapted for use in connection with such series cutouts, and for other uses, the predominant object of the invention being to provide an improved gap link which is so constructed and is capable of such use that upon the occurrence of an open circuit in a street lighting circuit which includes a series cutout having associated therewith one of the improved gap links, a new circuit is completed across the gap of the gap link to bypass the portion of the portion of the original circuit in which the break occurs and maintain the remainder of the original circuit in operating condition.

As is quite generally known to persons familiar with such matters an ordinary street lighting circuit of 40 kw. capacity is usually made up of a number of miles of conductor and in these circuits open circuits occur from time to time, frequently during bad weather conditions. It is not a simple matter to patrol these extensive street lighting circuits, particularly on a stormy night, and locate and repair open circuits, and this renders such faults both costly to the power companies and hazardous to the distribution maintenance men whose duties require them to keep the circuits in operating condition.

In order to eliminate much of the trouble heretofore encountered in maintaining street lighting circuits in working condition series cutouts were developed which are so arranged in the circuits and are capable of such use that the long circuits are broken into relatively small component sections, any one of which may be bypassed from the remainder of the circuit when an open circuit occurs in the component section. Because of this arrangement the length of the circuit to be patrolled to locate an open circuit may be reduced by any desired amount, depending on the number of cutouts installed.

The predominant feature of the present invention has to do with an improved gap link which may be applied to a suitable cutout structure installed in association with a street lighting circuit, the gap link being arranged in series and connected across the main circuit. When, in the operation of a street lighting circuit, in which a series cutout is arranged that includes one of the improved gap links, an open circuit occurs beyond the cutout, the voltage across the gap of the gap link of the cutout will increase to the open circuit voltage of the constant current transformer. The gap then sparks over and the heat of the arc produced at the gap melts a body of solder whereby a movable part of the gap link, which is normally held against movement by the body of solder, is released for movement to close the gap. Such closing of the gap completes a new circuit from which the section of the original circuit in which the open circuit occurred is bypassed, the new circuit being reestablished in an operating condition.

Fig. 1 is a view partly in vertical section and partly in elevation showing a series cutout with which is associated one of the improved gap links.

Fig. 2 is a greatly enlarged view partly in vertical section and partly in elevation of one of the improved gap links.

Fig. 3 is a wiring diagram of a conventional series street lighting circuit, showing one manner of arranging therein cutouts provided with the improved gap links disclosed herein.

Fig. 4 is a wiring diagram of a series street lighting circuit with grounded return, showing one manner of arranging therein cutouts provided with the improved gap links disclosed herein.

In the drawings, wherein is shown for the purpose of illustration, merely, one embodiment of the invention, A designates generally a suitable cutout structure. The cutout structure A comprises a housing 1, which preferably is formed of porcelain or other suitable insulating material, said housing adjacent to its lower end being provided with fixed hinge elements 2. The housing 1 has fixed to it, through the instrumentality of a bolt 3, a suitable hanger 4 which serves in an obvious manner to attach the device to a support (not shown). The housing 1 includes a door 5 which is formed of Bakelite, or other suitable material, and said door is provided with hinge elements 6 which are shaped to engage the hinge elements 2 of the body portion of the housing in a manner to provide for hingedly supporting the door 5 on the body portion of the housing.

Arranged in the upper portion of the housing 1 is an upper contact assembly which includes a base element 7 formed of electrical conducting material, and arranged in contact with said base element is an upper contact element 8, said contact element being secured in place with the housing by suitable fastening means 9 as shown in Fig. 1. The contact element 8 is formed from a length of relatively heavy, resilient wire, bent

to provide said contact element with a coiled portion 10 and horizontally spaced and forwardly extended portions 11 which are provided with portions 12 shaped to provide keeper portions. The horizontally spaced portions 11 of the upper contact extend upwardly from the keeper portions 12 and are projected rearwardly as shown in Fig. 1 at 13 and 14, respectively, the opposed portions 14 being extended toward each other at their rear ends and being joined by a tubular element 15. The base element 7 is arranged in electrical contact with a conductor C which forms a part of the circuit with which the cutout structure is associated by means of a suitable connecting assembly 16, the upper contact also being in electrical contact with said conductor C because it is in electrical contact with said base elements.

In the lower portion of the housing 1 a lower contact 17 is provided which is secured in place within the housing, and in electrical contact with a base element 18, by suitable fastening means 19 as shown in Fig. 1. The lower contact 17 is formed from a length of relatively heavy, resilient wire which is provided with a coiled portion 20 from which is extended downwardly and outwardly a loop portion 21. Also the lower contact 17 is arranged in electrical contact with a conductor C', which forms a part of the circuit with which the cutout structure A is associated, through the instrumentality of a suitable connecting assembly 22 which directly connects the base element 18 to the conductor C' and thereby places the lower contact in electrical connection with the conductor C' because said lower contact is in electrical contact with said base element.

Formed on the door 5 is an inwardly projected extension 23 in which an opening 24 is formed, and secured by screws 25 to the lower portion of the door 5 is a bracket 26 having a horizontally extended portion 27 through which a similar opening 28 is formed. Also at the upper portion of the bracket 26 a horizontal extension 29 is formed thereon through which an opening 30 is formed, and this horizontal extension is provided with oppositely extended, fixed contact pins 31 (only one being shown in Fig. 1), which contact with the loop portion 21 of the lower contact 17 when the door 5 is in a closed position. Obviously the bracket 26 and the parts thereof specifically referred to above are formed of electrical conducting material.

Supported by the horizontally extended portion 27 is a tube structure 32 which is disposed vertically within the housing 1 and is extended through the opening 24 of the extension 23, said tube structure being rigidly fixed to the portion 27 of the bracket 26 in any suitable manner, such, for instance, as by being pinned thereto as indicated at 33 in Fig. 1. The tube structure 32 may be formed of any suitable material, for instance, said tubular structure may be made up of an outer tube formed of Bakelite and an inner tube formed of horn fiber as shown in Fig. 1 wherein the outer tube is designated by the reference character 35 and the inner tube is designated by the reference character 34. At the upper end of the tube structure 32 a head 36 is mounted thereon, said head being formed of electrical conducting material and being provided with an internally screwthreaded lower portion which is arranged in screwthreaded engagement with an externally screwthreaded upper portion of the outer tube 35. The head 36 is provided with a shoulder 35' with which the upper end of the tube structure 32 contacts, and the upper portion of the head 35 is of slightly reduced diameter and is externally screwthreaded, as shown in Fig. 1, there being an opening 37 formed through said upper portion of the head which is of substantially the same diameter as the diameter of the bore of the tube structure.

The head 36 at the upper end of the tube structure 32 has extended therefrom in opposite directions a pair of contact pins 38 (only one thereof being shown in Fig. 1) which are adapted to be engaged by the keeper portions 12 of the spaced portions 11 of the upper contact 8, such engagement of the keeper portions 12 and the contact pins 38 serving the dual purpose of latching the door in its closed position and making electrical contact between the upper contact 8 and the head 36. The door 5 is provided with an extension 39 which has formed therein an opening 39' that is adapted to receive a suitable tool, the finger of a switch stick, for instance. When the door is in an open position and it is desired to close same the finger of a switch stick is introduced into the opening 39' of the extension 39 of the door and said door is rotated about the hinge members 2 toward its closed position, the contact pins 38 moving against the curved lower portions of the spaced parts 11 of the lower contact to cam said contact parts upwardly and permit said contact pins to move into latching engagement with the keeper portions 12 of the upper contact. Thus electrical contact will be made between the upper contact 8 and the head 36 at the upper end of the tube structure 32, and, at the same time, electrical contact will be made between the lower contact 17 and the contact pins 31 on the portion 29 of the bracket 26 at the lower portion of the door 5. Obviously when it is desired to open the door the finger of a switch stick is engaged with extension 39 of the door and said door is pulled outwardly to free the contact pins 38 from the keeper portions 12 of the upper contact.

Associated with the tube structure 32 of the cutout structure illustrated in Fig. 1 is the gap link 40 which constitutes the predominant feature of the present invention. The gap link comprises a tubular element 41 which is formed of suitable electrical insulating material, steatite ceramic material, for instance, and said tubular element 41 is internally screwthreaded at its opposite ends. Associated with the tubular element 41 at one end thereof is an electrode 42, said electrode including an outer portion 42*a* which is externally screwthreaded and which screwthreadedly engages an internally screwthreaded end portion of the tubular element 41, and an inner portion 42*b* of reduced diameter which joins the outer electrode portion 42*a* at an annular shoulder 43. At the outer end of the outer electrode portion 42*a* a button 44 is fixed thereto, said button including a sleeve portion 44*a* which embraces the end portion of said electrode portion 42*a*, and a portion 44*b* of increased diameter.

Mounted for sliding movement on the electrode portion 42*b* is a sleeve 47 which is formed of electrical conducting material, and interposed between the shoulder 43 of the electrode 42 and the adjacent end face of the sleeve 47 is a coil spring 48 which surrounds a portion of the electrode portion 42*b*. The sleeve 47 is normally positioned on the electrode portion 42*b* so as to com-

press the coil spring 48, and said sleeve is held in such position with respect to the electrode portion 42b by a body of solder 49 which is applied to the end portion of the electrode portion 42b and abuts against the adjacent end of the sleeve as shown in Fig. 2. From the foregoing it is plain that the compressed coil spring 48 tends to move the sleeve 47 longitudinally of the electrode portion 42b but that the body of solder prevents such movement of the sleeve.

Associated with the tubular element 41 of the gap link 40 at the opposite end of said tubular element is a second electrode 50 which comprises an electrode portion 50a that is externally screwthreaded and is disposed in screwthreaded engagement within the internally screwthreaded portion at said opposite end of said tubular element 41. The electrode 50 includes also an electrode portion 50b of reduced diameter which is provided with an end portion 51 of further decreased diameter, and applied to said electrode portion 51 is a body of solder 52 which adheres to the circumferential surface of said electrode portion 51 and contacts with the shoulder 53 at the point of junction of the electrode portions 50b and 51. It is to be noted that the bodies of solder 49 and 52 are of tapered formation, said bodies of solder tapering from a larger to a smaller diameter as the outer ends of the electrode portions 42b and 51 are approached. It is also to be noted that the adjacent ends of the electrode portions 42b and 51 are spaced apart to provide a gap 54 therebetween, and, if desired the wall of the tubular element 41 may be provided with opposed and alined openings 55 which may be useful in predetermining the extent of the gap 54. At the end of the electrode 50 opposite from the end thereof at which the electrode portion 50b is located, said electrode is provided with an extension 56 which fixedly engages a flexible conductor 57.

The gap link 40 is associated with the tube structure 32 of the cutout structure A by feeding the flexible conductor 57 through said tube structure and drawing the enlarged portion 44b of the button 44 into seated relation with the top face of the head 36 as shown in Fig. 1. In order to insure good electrical contact between the enlarged portion 44b of the button 44 and the top face of the head 36, a cap 58 is provided which is internally screwthreaded, said cap being screwthreadedly applied to the externally screwthreaded upper portion of the head so that an inner face 58' of said cap contacts forcibly with the curved top face of the button 44 whereby the lower face of the enlarged portion of the cap is forced into firm contact with the top face of the head 36. The lower end portion of the flexible conductor 57 extends from the lower end of the tube structure 32, said portion of said flexible conductor being drawn about the lower edge of said tube structure and extending upwardly to a point where it is engaged by a wing nut 59 which is mounted on a screwthreaded element 60 that is fixed to the portion 27 of the bracket 26 secured to the lower portion of the door 5.

When, in the use of a cutout structure provided with the improved gap link disclosed herein, an open circuit occurs beyond the cutout, the voltage across the gap 54 will increase to the open circuit voltage of the constant current transformer. The gap 54 then sparks over and the heat of the arc produced at the gap will melt the bodies of solder 49 and 52, the melting of the body of solder 49 releasing the sleeve 47 and permitting the coil spring 48 to move said sleeve longitudinally of the electrode portion 42b, across the gap 54, and into contact with the electrode portion 50b of the electrode 50. Such movement of the sleeve will complete a path of current through the gap link 40 and the molten bodies of solder 49 and 52 will immediately harden to provide good electrical connection between the sleeve and the electrode 50.

Fig. 3 illustrates in diagram a conventional series street lighting circuit in which T designates the transformer and La, Lb, Lc, and Ld designate loop circuits which form parts of the main circuit. The diagram of Fig. 3 includes also cutouts Aa, Ab, Ac, and Ad, each of which is connected across one of the loop circuits. Fig. 3 illustrates an open circuit occurring at the point designated by the reference character B in the loop circuit La, and as a result of said open circuit the gap of the gap link of the cutout Aa is closed thereby by-passing the faulty loop circuit La and maintaining the remainder of the circuit in operating condition. It is obvious that if an open circuit occurred in any of the other loop circuits the same result would be attained, the loop circuit in which the open circuit occurred being by-passed by operation of the cutout associated with the faulty loop circuit and said remainder of the main circuit remaining in operative condition.

Fig. 4 illustrates in diagram a series street lighting circuit which is provided with a transformer T and grounded neutral returns G. The diagram shows cutouts Aa, Ab, and Ac, which at different points are connected into the circuit and to grounded neutrals. When, in the operation of such a system an open circuit occurs in the circuit, the closest cutout between the point at which the open circuit occurs and the transformer is operated so that the gap of the gap link of said cutout is closed. This by-passes the portion of the original circuit beyond the operated cutout and maintains in operative condition the portion of the original circuit between the transformer and the operated cutout, the current passing through the closed gap link of the operated cutout to ground. In Fig. 4 the open circuit is indicated at B' and the cutout Ac is shown as having been operated to close the gap thereof. This results in the portion of the circuit beyond the operated cutout being by-passed from the remainder of the circuit and said remainder of the circuit being maintained in operating condition.

When a cutout has been operated to close the gap of the gap link thereof as has been explained hereinbefore and it is desired to restore the operated cutout to its normal condition after the open circuit has been repaired, it is necessary to merely draw the door of the cutout open and remove the door from the hinge elements 2 of the housing 1. The operated fuse link is then replaced by a new gap link and the door is restored to its position in engagement with the hinge elements 2 and is moved to its closed position.

In some cases it may be necessary to de-energize the entire series circuit to restore normal operation after an open circuit has been repaired. This situation may be due to the fact that voltage may be impressed across the opening contacts of the operated cutout in proportion to the voltage of the load beyond the cutout. Thus, if the fault were located at a point near the transformer, that is if the cutout Aa of Fig. 4 were

involved, approximately three times the voltage would be impressed across the cutout contacts as would in the case illustrated in Fig. 4. For such a situation it would be necessary to de-energize the entire circuit to restore service to the entire circuit.

I claim:

1. A gap link for an electrical cutout associated with an electrical circuit, which comprises a unitary link structure provided with spaced elements providing a gap, means supported by one of said spaced elements for movement across the gap and into contact with the other of said spaced elements to close said gap for passage of current thereover in response to a change in voltage in the electrical circuit with which the cutout is associated, meltable means for normally maintaining said gap-closing means in a position where the gap is not closed thereby, and means for moving said gap-closing means to the gap-closing position on melting of said meltable means as a result of heat produced by an arc formed across the gap, said meltable means being adapted also to weld said movable means to the spaced element into contact with which it moves to provide good electrical connection between said parts.

2. A gap link for an electrical cutout associated with an electrical circuit, which comprises a unitary link structure provided with spaced elements providing a gap, an insulating tube which supports said elements and embraces the gap therebetween, means supported by one of said spaced elements for movement across the gap and into contact with the other of said spaced elements to close said gap for passage of current thereover in response to a change in voltage in the electrical circuit with which the cutout is associated, meltable means for normally maintaining said gap-closing means in a position where the gap is not closed thereby, and means for moving said gap-closing means to the gap-closing position on melting of said meltable means, said meltable means being adapted also to weld said movable means to the spaced element into contact with which it moves to provide good electrical connection between said parts.

3. A gap link for an electrical cutout associated with an electrical circuit, which comprises a unitary link structure provided with spaced elements providing a gap, an insulating tube which supports said elements and embraces the gap therebetween, means supported by one of said spaced elements for movement across the gap and into contact with the other of said spaced elements to close said gap for passage of current thereover in response to a change in voltage in the electrical circuit with which the cutout is associated, meltable means for normally maintaining said gap-closing means in a position where the gap is not closed thereby, said meltable means being applied to the spaced element that supports said gap-closing means and being arranged in engaging relation with respect to said gap-closing means, a second meltable means applied to the spaced element into contact with which said gap-closing means is adapted to move, and means for moving said gap-closing means to the gap-closing position on melting of the first-mentioned meltable means, said first-mentioned meltable means and the second-mentioned meltable means being adapted to weld said movable means to the spaced element into contact with which it moves to provide good electrical connection between said parts.

4. A gap link for an electrical cutout associated with an electrical circuit, which comprises a unitary link structure provided with spaced elements providing a gap, means supported by one of said spaced elements for movement across the gap and into contact with the other of said spaced elements to close said gap for passage of current thereover in response to a change in voltage in the electrical circuit with which the cutout is associated, meltable means for normally maintaining said gap-closing means in a position where the gap is not closed thereby, said meltable means being applied to the spaced element that supports said gap-closing means and being arranged in engaging relation with respect to said gap-closing means, a second meltable means applied to the spaced element into contact with which said gap-closing means is adapted to move, and means for moving said gap-closing means to the gap-closing position on melting of the first-mentioned meltable means as a result of heat produced by an arc formed across the gap, said first-mentioned meltable means and said second-mentioned meltable means being adapted to weld said movable means to the spaced element into contact with which it moves to provide good electrical connection between said parts.

5. A circuit completing device comprising spaced elements providing a gap therebetween, means supported by one of said spaced elements for movement across the gap and into contact with the other of said spaced elements to close said gap for passage of current thereover, meltable means for normally maintaining said gap-closing means in a position where the gap is not closed thereby, and means for moving said gap-closing means to the gap-closing position on melting of said meltable means as a result of heat produced by an arc formed across the gap, said meltable means being adapted also to weld said movable means to the spaced element into contact with which it moves to provide good electrical connection between said parts.

6. A circuit completing device comprising spaced elements providing a gap therebetween, means supported by one of said spaced elements for movement across the gap and into contact with the other of said spaced elements to close said gap for passage of current thereover, meltable means for normally maintaining said gap-closing means in a position where the gap is not closed thereby, a second meltable means applied to the spaced element into contact with which said gap-closing means is adapted to move, and means for moving said gap-closing means to the gap-closing position on melting of the first-mentioned meltable means as a result of heat produced by an arc formed across the gap, said first-mentioned meltable means and said second-mentioned meltable means being adapted to weld said movable means to the spaced element into contact with which it moves to provide good electrical connection between said parts.

GEORGE W. GOLDNER.