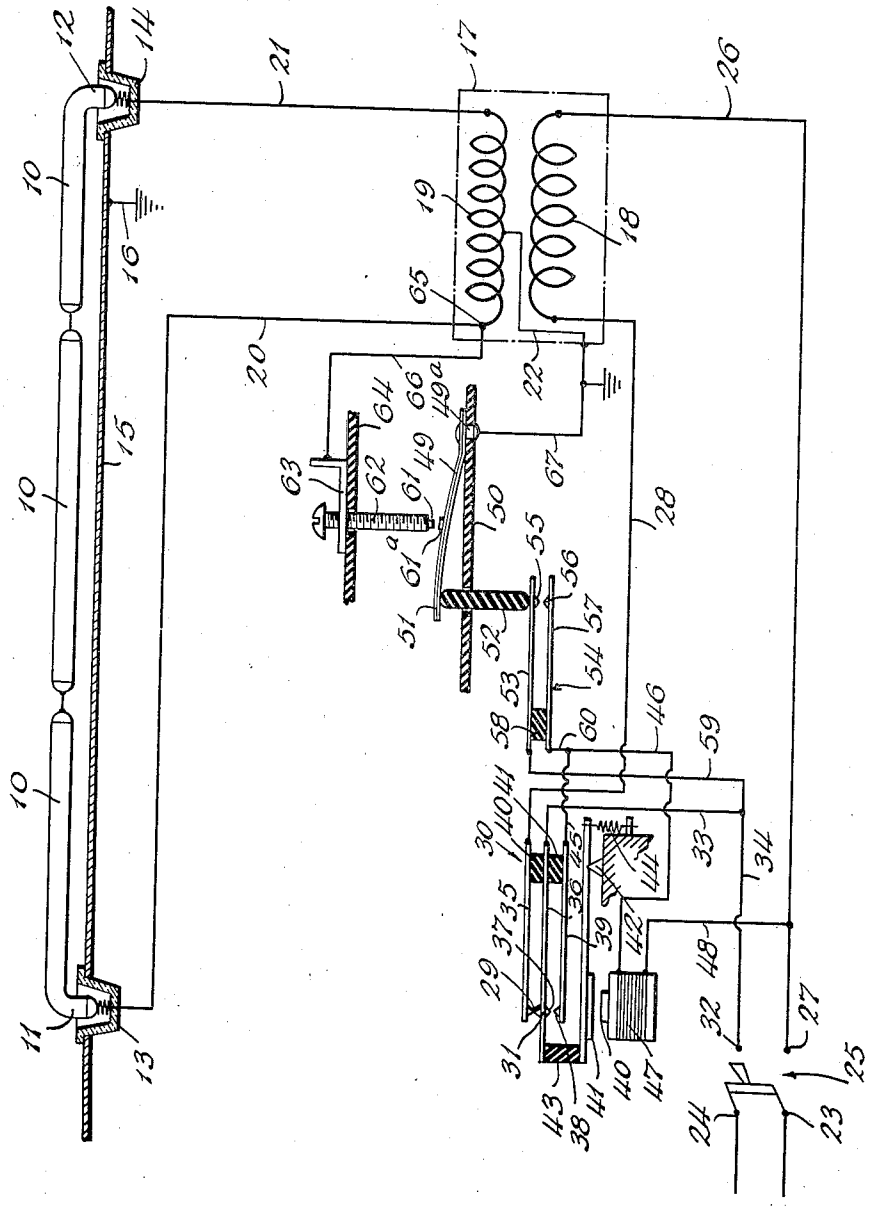
Dec. 31, 1946. R. J. LEVERTE 2,413,327

AUTOMATIC CUT-OUT FOR NEON SIGN OR LIKE CIRCUITS

Filed Aug. 13, 1941 2 Sheets-Sheet 1

Fig. 1.



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Filed Aug. 13, 1941 2 Sheets-Sheet 2

Fig. 2.

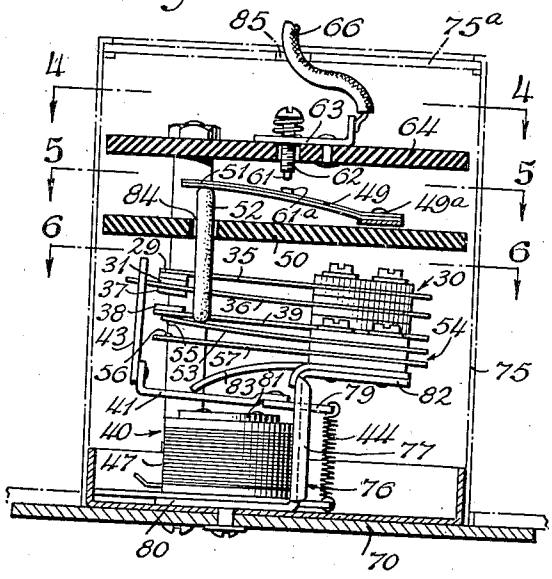


Fig. 3.

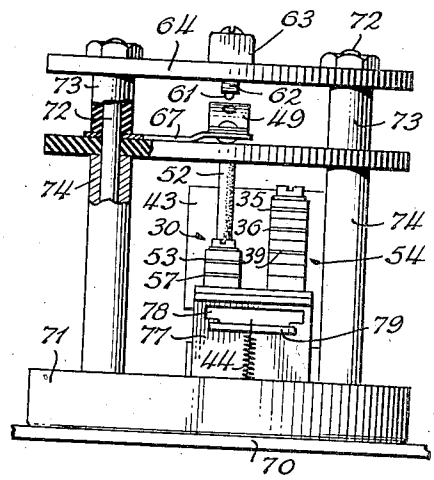


Fig. 4.

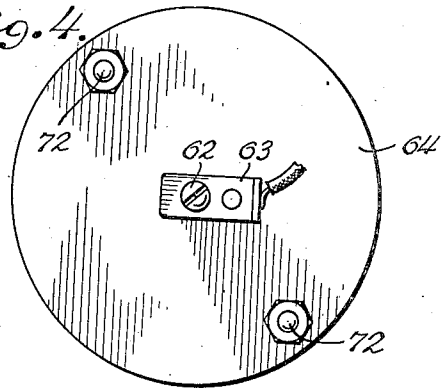


Fig. 6.

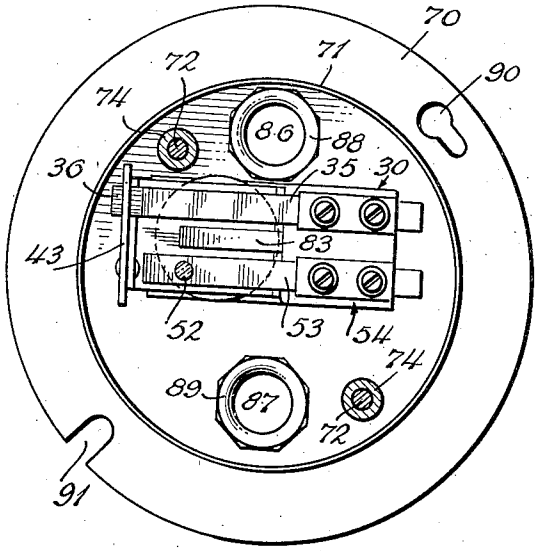
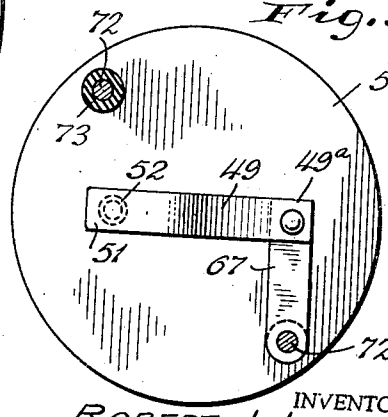


Fig. 5.



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UNITED STATES PATENT OFFICE

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AUTOMATIC CUTOUT FOR NEON SIGN OR LIKE CIRCUITS

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Application August 13, 1941, Serial No. 406,655

2 Claims. (Cl. 175—294)

1

This invention relates generally to automatic cut-out arrangements for electric circuits, and more particularly to automatic cut-out arrangements for high tension electric circuits, which become active upon the occurrence of an open circuit therein.

More specifically, my invention relates to an arrangement of the character described in which the human equation has been eliminated, so that it is fool-proof in operation, whereby damage to the installation and to repair and maintenance men is averted.

My invention has been disclosed herein in its application to luminous, gaseous, discharge tube installations because it has particular utility for that purpose. However, it will be understood that its application is not necessarily so restricted, and that, particularly as to certain phases thereof, it may have far wider application.

In order to provide the high voltages necessary for the operation of luminous gaseous discharge tubes, they are, in the conventional circuit, connected across the secondary of a step-up transformer of the appropriate voltage. The no-load voltage of such a transformer is high, which is necessary for starting the tubes; after the operation starts and during the normal operation of the tubes, the voltage drops considerably. The circuits are designed for continuous operation on the said lower voltages which exist during normal operation, but not for exposure to the high no-load voltage which occurs on starting or whenever a break in the circuit occurs, as for instance, if one of the tubes should fail. Not merely is this high voltage harmful to the circuit, but it is dangerous as well.

It has heretofore been proposed to protect and safeguard such circuits by providing an automatic cut-out to deenergize the circuits when undesirable conditions exist. Devices of this type with which I am familiar leave much to be desired in many respects, among which I may mention that they are unreliable in operation, they are not fool-proof, they require manual resetting, they are not compact, nor simple, and many of them are unnecessarily expensive.

It is the general object of my invention to provide an arrangement of the character described that is simple, effective and economical in first cost and in operation and maintenance costs.

Among the more particular objects of my invention are the provision of a device of the character described that is fool-proof in that the human equation is eliminated by circuits and

2

devices that will assure effective operation in automatically rendering the defective circuit inactive and maintaining it in such inactive condition for an indefinite time until the connection with the power source has been broken, and further additionally, an arrangement in which no manual resetting is required beyond disconnecting the arrangement from the power source, after which, on reestablishing such connection, the parts will assume their normal operative position.

Among the more particular objects of my invention are further the provision of a unitary cut-out device of simple construction in which are assembled in the proper operative relationship all the necessary elements to effect the automatic cut-out operations so that installation requires merely the connection of a few wires to the power source and the transformer, where this is part of the circuit to be protected, as is the case with a luminous, gaseous, discharge tube installation.

It is also among the objects of my invention to provide in a unitary cut-out device of the character described, a casing divided into a compartment for the high tension circuits, and a compartment for the low tension circuits.

To attain these objects and such further objects as may appear herein or be hereinafter pointed out, I make reference to the accompanying drawings, forming a part hereof, in which—

Figure 1 is a diagrammatic view illustrative of the application of my invention to a luminous gaseous discharge tube installation;

Figure 2 is a vertical sectional view of a unitary device constituting an illustrative embodiment of my invention, the cover of the device being shown in broken lines;

Figure 3 is an elevational view of the device of Figure 2, as viewed from the right of said figure;

Figures 4, 5 and 6 are views taken, respectively, on the lines 4—4, 5—5 and 6—6 of Figure 2, looking in the direction of the arrows.

Referring now to the drawings in detail, and first of all to Figure 1, I have shown therein at 10 a plurality of luminous, gaseous, discharge tubes, serially connected and having the outer ends 11 and 12 of the end tubes seated in terminal sockets 13 and 14. The supporting frame 15 of these tubes is grounded in the conventional manner, as at 16.

At 17 is shown a transformer having a primary winding 18 and a secondary winding 19, this transformer being of the step-up type adapted to deliver a high secondary voltage when its

primary is connected to a source of alternating electric current of standard voltage, such as 110 volt house current.

The secondary winding 19 is connected to the terminal sockets 13 and 14 by conductors 20 and 21 and its mid-point is grounded, as at 22, in the conventional manner.

The primary winding 18 of the transformer is connected to the electric current source having terminals 23, 24 connected to a make and break device such as the switch 25, through a conductor 26, connected to terminal 27 of switch 25, and a conductor 28 running to one contact 29 of a three element make and break device 30, a second contact 31 of which is connected to the other terminal 32 of the switch 25 by conductor 33 and 34.

The make and break device 30 besides the contacts 29 and 31, carried respectively by legs or tongues 35 and 36, also comprises a pair of contacts 37 and 38, the former carried by the tongue 36 which also carries the contact 31, and the two contacts 31 and 37 are electrically united.

The contact 38 is carried by the tongue 39.

The three tongues 35, 36 and 39, which are electrically conducting, are mechanically united but electrically insulated from each other by insulating pieces 40 and 41. The tongue 36 is deformable so that it may assume a position in which contacts 29 and 31 touch each other, whereby the circuit of the primary winding is completed, and whereby a circuit including the other pair of contacts 37 and 38 is broken, or into a position in which the contacts 37 and 38 touch each other and the contacts 29 and 31 are separated, thereby breaking the circuit of the primary winding 18.

Movement of the tongue 36 is effected by an electromagnet 40, the armature 41 of which is pivotally mounted at 42, and is connected to the tongue 36 through an insulating piece 43, whereby the latter is caused to move together with the armature 40, which is normally urged by means, such as a tension spring 44, into a position in which the contacts 29 and 31 touch each other.

When the electromagnet 40 is energized, it breaks the primary circuit by causing separation of contacts 29 and 31, and, through the touching of contacts 37 and 38 establishing a holding circuit for the electromagnet 40, which circuit comprises the conductor 33, the tongue 36, the contacts 37 and 38, the tongue 39, the conductor 45, the conductor 46 leading into the winding 47 of the electromagnet 40 and the conductor 48 connecting said winding 47 with the conductor 26 leading to the power source.

Energization of the electromagnet 40 is initiated by the means now about to be described, and when this has taken place the holding circuit just described becomes effective.

At 49 I have shown a bimetallic thermo-responsive heating element, which is mounted at one end 49*a* on an insulating base 50 while its other end 51 is free to move in response to the biasing action of temperature changes in the element 49. The free end 51 thereof, on its downward movement, will press against a member, such as a rod 52 (of insulating material, porcelain being found desirable) whereby its downward movement is transmitted to the resilient tongue 53 of a two element make and break device 54, which is tensioned so as to assume a position in which the contact 55 carried on the end thereof is normally separated from the contact 56 carried by the tongue 57. Both

tongues 53 and 57 are spaced from each other by an insulating block 58.

The tongue 53 is shown connected to conductor 34 through a conductor 59, while the tongue 57 is shown connected to the conductor 46 by a conductor 60.

It will now be seen that when the thermo-responsive element 49 is biased or warped so that its end 51 moves downwardly to a sufficient extent, the contacts 55 and 56 will close a circuit comprising the conductors 34 and 59, the make and break device 54, the conductors 60 and 46, the electromagnet coil 47 and the conductors 48 and 26, whereby the electromagnet 40 will be energized and the circuit of the primary winding 18 of the transformer will be broken.

Temperature changes in the thermo-responsive element 49 are caused whenever a break occurs in the circuit of the secondary winding 19 of the transformer 17 by an arrangement comprising a contact point 61 carried on the end of a member 62, such as a screw, adjustably mounted in a conducting plate 63 which is mounted on an insulating base 64 and connected to one terminal 65 of the secondary winding 19 by a conductor 66, and further, a contact 61*a* on the thermo-responsive element 49. The end 49*a* of the element 49, which is electrically conducting, is grounded through the conductor 67.

When a break occurs in the circuit of the transformer secondary 19, the voltage rises to the no-load voltage value, which causes a spark to jump between the contact 61 to the contact 61*a* on the element 49. It will be understood that the spark gap is adjusted to permit this by means of the screw 62. The spark gap circuit, as shown in the drawings, comprises the conductor 22, the portion of the secondary winding 19 between the conductor 22 and terminal 65, the conductor 66, the plate 63, the screw 62 and its contact 61, the gap between contact 61, contact 61*a* of the element 49, the element 49 and its contact 61*a* and the conductor 67.

The passage of current through the element 49 will heat the same so as to cause biasing or warping thereof in a direction which will close the contacts 55 and 56 and thereby energize the electromagnet 40.

The operation of the arrangement as a whole will now be summarized.

When the secondary circuit of the transformer is open circuited, as by failure of one of the tubes 16, the secondary voltage rises sufficiently to cause a spark to jump between contact 61 and contact 61*a* of element 49, and due to heating of the latter, its end 51 moves down so as to cause the make and break device 54 to energize electromagnet 40 and thereby open the circuit of the transformer primary 18, while at the same time, through contacts 37 and 38, the holding circuit becomes effective to maintain the electromagnet in energized condition until the switch 25 is thrown. When this is done the holding circuit is broken and the electromagnet 40 is deenergized.

While the repairs to or replacements in the defective circuit may, under certain conditions, be made before the switch is thrown, it is of course preferable to disconnect the circuit completely from the power source before attempting such repairs or replacements. In the meantime, before the switch 25 is thrown, the circuit is being protected against injury by the automatic cut-out action.

As soon as the cut-out action takes place the

spark gap circuit of course becomes inactive and the thermo-responsive element 49 cools and permits the contacts 55 and 56 to separate, which would result in deenergization of the electromagnet 40 except for the action of the holding circuit, which maintains it energized until the switch 25 is opened. When this is done, assuming that the repair or replacement has been made and that the element 49 has cooled sufficiently to permit the contacts 55 and 56 to separate, the electromagnet 40 is deenergized.

It will be observed that my arrangement as described affords a high degree of effectiveness and convenience, in that the human factor is entirely eliminated. A condition of safety is created entirely by automatic action and normalcy is restored by the obvious expedient of disconnecting the circuit either before or after the necessary repairs or replacements are made.

My arrangement, illustratively embodied in compact practical form, is shown in Figures 2 to 6. Most of the parts of the device shown therein have already been sufficiently described in connection with the diagrammatic showing of Figure 1. These parts are numbered identically in both Figures 1 and Figures 2 to 6 and need not be again mentioned except in respect to constructional characteristics thereof having a functional significance. Other parts will now be described in detail.

On a metallic base plate 70 are mounted a flanged metallic plate 71 and insulating plates 50 and 64, the whole being held together by the bolts 72, which have spacing bushings 73 and 74 thereon to properly space the plates 50 and 64 from each other and from the plate 71. The bushings 73 are of insulating material because of their proximity to the high tension currents.

The flanged portion of plate 71 serves as a seat for a cap or cover 75, indicated in broken lines in Figure 2, and the end 75a of which is preferably of insulating material for a purpose that will presently appear, which encloses the entire assembly and serves to protect the same as well as providing a safeguard against the high tension currents that traverse portions thereof.

Mounted on the plate 71 is the electromagnet 40, the yoke of which is in the form of an angled plate 76, in the vertical leg 77 of which is a slot 78, within which is pivoted a plate 79, the outer end of which is pulled downwardly by the spring 44 and the inner end of which carries the armature 41, the latter in turn carrying the insulating plate 43, which transmits the movements of the armature 41 to the tongue 36.

The horizontal leg 80 of the yoke plate 76 underlies the electromagnet 40 and from it projects the core 81 of the electromagnet which is surrounded by its field coil 47.

The upper leg 77 of the yoke plate 76 has an extension 82 thereon and on this extension are mounted a stop 83, which limits the upward movement of the armature 41, and the make and break devices 30 and 54, these being of the "jack" type and of more or less conventional, standard construction so that further description thereof appears superfluous.

The plates 70 and 71 and the sides of the cover 75 are made electrically conducting, for which purpose they may conveniently be made of metal, and the casing formed thereby is grounded, whereby it shields the parts enclosed thereby, both mechanically and electrically. The latter function is important because of the high tension circuits within the casing.

It will be observed that the space within the said casing is divided into a high tension compartment, which is bounded by the plates 50 and 64, and a low tension compartment, which is positioned below the plate 50. The only communication between the two compartments is through the insulating rod 52 which passes through an opening 84 in the plate 50, so that there is little danger of high tension leakage into the low tension circuits. The end 75a of the cover 75 is also of insulating material for protection against high tension leakage at this point.

The conducting construction of the casing of the cut-out device affords a convenient means of grounding the spark gap circuit. This is effected through the conductor 67 which connects the end 49a of the thermo-responsive element 49 with a bolt 72, through which it is electrically connected to the case, which is suitably grounded.

The high tension conductor 66 leading to the transformer secondary passes through an opening 85 in the end 75a of cover 75, and openings 86 and 87, having suitable bushings 88 and 89 seated therein, are provided for the low tension wires, one pair (28 and one end of 26 of Figure 1) passing through one of these openings to the transformer primary, while another pair (34 and the other end of 26 of Figure 1) passes through the other opening for connection to the power source.

For convenience in mounting the cut-out device in a desired place I may provide suitable arrangements such as the key-hole slot 90 and the radial slot 91 shown in Figure 6, the utility of which is so obvious as to require no further explanation.

It will therefore be observed that I have provided a protective cut-out arrangement that is simple, economical and fool-proof, and a unitary device of simple, compact, effective and economical construction, in which the elements constituting the cutout proper are assembled in convenient form.

It will be understood that while I have herein disclosed one embodiment of my invention, that the same may be embodied in many other forms and the elements thereof arranged in many other combinations without departing from the spirit thereof, as will be obvious to those skilled in the art. It will further be understood that the disclosure herein is by way of illustration merely and is not to be construed in a limited sense, and that I do not limit myself other than as called for by the prior art.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is:

1. An automatic cut-out device for the high tension circuit of a neon sign installation or like comprising in combination an electromagnetic relay including a coil and a core, a field piece having an upright leg including a body portion adjacent the coil, an armature hingedly mounted at one end on said upright leg of the field piece, including a portion for registry with the end of said core, an extension piece on said body portion for hingedly supporting the armature normally out of direct contact with the field piece, a pair of spring bar type of conductor fingers mounted upon said extension and insulated from each other at one end thereof and carrying contacts adjacent the other end normally spaced from

each other, a common spring bar type of conductor finger mounted in insulated relation between said first fingers and having contacts common to each of the contacts of the first fingers, said common finger normally being urged against one of the fingers and including an extension connecting the same in insulated relationship to said armature for movement of said common finger and armature substantially in unison, a switch for said magnetic relay comprising a pair of spring bar type of fingers having cooperative contacts normally spaced from each other, a bi-metallic strip mounted on said support, a contact for said strip cooperatively spaced from a second contact providing a spark gap for heating said bimetallic strip to warp the same by the heat of the spark, and insulated means connected to said strip to contact and move said fingers of said switch towards each other, to close the electrical circuit actuating said relay upon deflection of said strip by the heat of said spark gap.

2. An automatic cut-out device for the high tension circuit of a neon sign installation or like comprising in combination an electromagnetic relay including a coil and a core, a field piece having an upright leg including a body portion adjacent the coil, an armature hingedly mounted at one end on said upright leg of the field piece, including a portion for registry with the end of

said core, a support on said body portion for movably mounting the armature normally out of direct contact with the field piece, a pair of yieldable conductor fingers mounted upon said support and insulated from each other at one end thereof and provided with contacts adjacent the other end normally spaced from each other, a common yieldable conductor finger mounted in insulated relation between said first fingers and having contacts common to each of the contacts of the first fingers, said common finger normally being urged against one of the fingers and including an extension connecting the same in insulated relationship to said armature for movement of said common finger and armature substantially in unison, a switch for said magnetic relay comprising a pair of yieldable fingers having cooperative contacts normally spaced from each other, an element responsive to the heat of a spark for effecting movement thereof, mounted on said support, a contact for said element cooperatively spaced from a second contact providing a spark gap for heating said element, to move the same by the heat of the spark, and insulated means connected to said element to contact and move said fingers of said switch towards each other, to close the electrical circuit actuating said relay upon movement of said element by the heat of said spark gap.

ROBERT J. LEVERTE.