

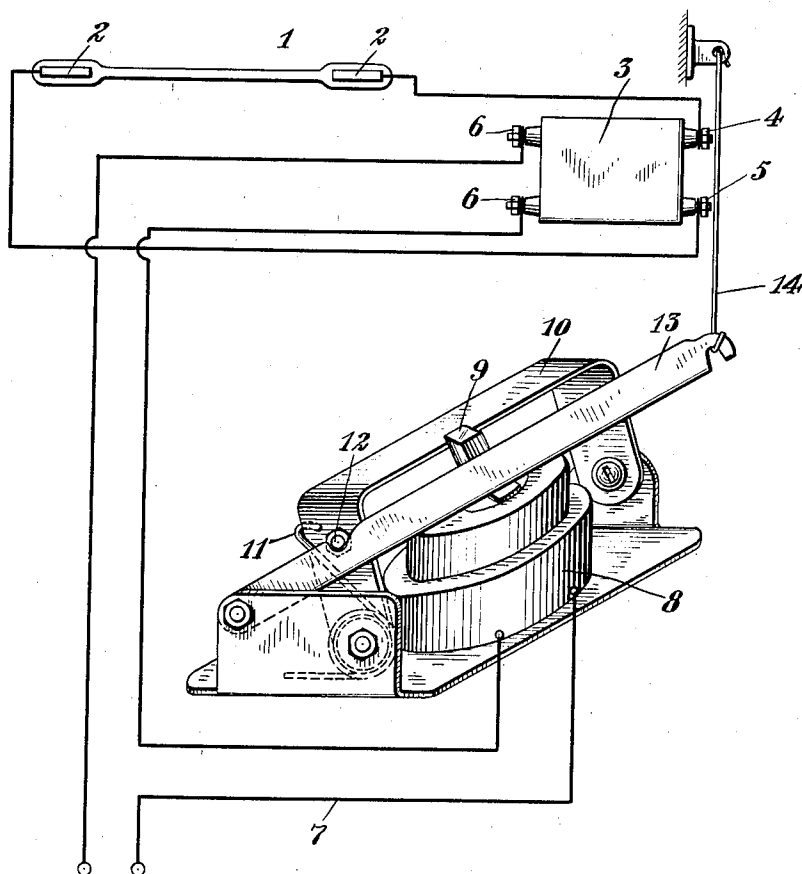
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ELECTRICAL CUT-OUT

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ELECTRICAL CUT-OUT.

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My invention relates to certain new and useful improvements in electrical cut-outs designed particularly for use in connection with the operation of luminous discharge tubes employing a rarefied gaseous atmosphere through which an electric current is passed to secure illumination. The invention may be used in connection with any electric appliance in which similar or analogous conditions are encountered as with these luminous discharge tubes.

In the operation of a luminous discharge tube a very high starting voltage is required. When the tube has been once started the voltage necessary to maintain it in operation is very much reduced and may be 50% or less of the starting voltage. These luminous discharge tubes are usually operated by means of transformers, the primaries of which are connected to the usual 110 volt or 220 volt alternating current supply, and the transformers are designed usually to have an open circuit voltage sufficiently high to start the tube. Obviously, should the tube break or should the secondary circuit be broken or grounded, the open circuit voltage will rise to its maximum value. Under such condition the transformer will constitute a menace to life as well as a source of fire. Such a condition would not be corrected by the use of an ordinary fusible cut-out in the primary circuit, for the reason that in the operation of these luminous tubes limited current transformers are employed with high inductive reactance, or auxiliary inductance coils are used in order to limit the current to a desired commercial value. Therefore, should the secondary be open circuited for any reason, the primary current would be of its minimum value. Thus, the use of a fusible cut-out in the primary circuit is ineffective to meet the condition above pointed out.

With my improved cut-out I provide for the breaking of the primary circuit, should the voltage in the secondary rise to a dangerous value, as, for example, when the transformer is used for the operation of a luminous discharge tube and the tube breaks or if the secondary circuit is broken or becomes grounded.

In order that the invention may be better understood, attention is directed to the accompanying drawing, showing an embodiment thereof, the mechanical parts being

illustrated in perspective and the circuits and transformer being shown diagrammatically.

I here illustrate the invention applied in connection with a luminous discharge tube, although, as I have pointed out, it may be utilized in connection with any electrical appliance or apparatus in which the same or analogous characteristics are present. 1 represents a luminous discharge tube filled with a rarefied gaseous atmosphere such as neon or argon having interior electrodes 2—2 of the usual type. The representation of the tube is purely diagrammatic. Ordinarily, these tubes are very long and are bent into the form of letters or symbols to constitute a sign. The transformer 3 has the secondary terminals 4 and 5 in circuit, as shown, with the electrodes 2—2. It also has the primary terminals 6—6 in a primary circuit 7 connected to the usual alternating current supply.

The transformer 3 is so designed as to have an open circuit voltage at the secondary sufficiently high to start the tube, and it is also designed, or is provided with associated apparatus, to limit the current of the secondary circuit. With an ordinary neon sign this secondary current is of the order of 30 milliamperes more or less.

In the primary circuit 7 is a switch 8, which may be of any suitable construction. The switch shown is provided with a tumbler 9 which when moved to the right will break the primary circuit. This tumbler is shown as being operated by a bail 10 having a spring 11 tending to move the same when released to break the primary circuit. A stud 12 on the bail 10 co-operates with a notch in a trigger 13 so as to normally hold the switch in its closed position. This trigger is normally held in the position shown by a link 14 made of suitable fusible wire.

The said link preferably extends in front of the two secondary terminals 4 and 5, as shown, so as to form two gaps between said terminals and the link. The distance between link 14 and the two terminals 4 and 5 is such that under open circuit conditions the secondary voltage will be sufficient to bridge the two gaps in series, but under normal working conditions the voltage will not be sufficient for this purpose. If the tube 1 is then operating under proper condition with the elements of the cut-out in the position

shown, when the primary circuit is closed, there will be an instantaneous rise of voltage to the maximum value in starting the tube and momentary sparking will take place between the secondary terminals 4 and 5 and the link 14. This is only momentary, however, and will not be sufficient to fuse the link. As soon as the tube starts, the voltage will drop and the sparking will cease. If, however, the tube should break or the secondary circuit should be broken, the secondary voltage will rise to its maximum value, thus short circuiting the terminals 4 and 5 through the link 14, and in a few seconds the link will fuse, permitting the trigger 13 to drop, whereupon bail 10 will operate the tumbler 9 to break the primary circuit. Should the secondary circuit at any time become accidentally grounded the cut-out switch will also automatically operate, since that switch is also grounded (not shown) and the effect will then be to bring the terminals 4 and 5 in multiple with respect to the link 14 instead of being in series with each other, as is normally the case. In other words, the effect of grounding the secondary is practically to reduce the spark gap and thus permit the link to be fused even though the secondary potential may not rise to its maximum value. In order that the automatic operation of the switch, when either secondary is grounded, may be more clearly understood, the following explanation is made, the secondary lead from terminal 4 being referred to as the "upper secondary lead" and the secondary lead from terminal 5 being referred to as the "lower secondary lead."

In a typical case when the apparatus is operating under normal conditions, the voltage across the secondary terminals will be say from one-half to one-third the open circuit voltage, and as explained above, the gaps between the link 14 and the secondary terminals are so adjusted that at the reduced operating voltage there will be no sparking between these terminals and the link. Under normal conditions, in other words, the gaps are in series. Let it now be supposed that the upper secondary lead from terminal 4 becomes grounded, for instance by puncturing the insulation covering both leads. In this case it will be apparent that the secondary terminal will be at the same potential as the link, namely, zero potential, since the link 14 is always grounded. Consequently the operating voltage drop across the secondary terminals will now be applied to the single gap between the terminal 5 and link 14, sparking will occur and the link will fuse. In the same way should the lower secondary lead become grounded, sparking will take place between the secondary terminal 4 and the link, resulting in sparking and fusion of the link.

Although I prefer to arrange the link 14

adjacent both of the secondary terminals, as explained, this is not strictly necessary. The gap may exist between only one of these terminals and the link 14, in which case the secondary circuit will be grounded with respect to the link. With the proposed modification the single spark gap between one of the secondary terminals and the link will be so proportioned as to permit passage of the current under open circuit voltage conditions but prevent passage of current under normal working conditions. Therefore, should the tube break or should the secondary circuit be broken so as to result in the maximum open circuit voltage in the secondary, the current will bridge the single gap and result in the fusing of the link.

I prefer to arrange the link with respect to both the secondary terminals, because with this arrangement I not only am enabled to automatically break the primary circuit in the event of the breaking of the tube or the breaking of the secondary circuit, but also to break the primary circuit in case the secondary circuit is grounded.

Having now described my invention, what I claim as new therein and desire to secure by Letters Patent is as follows

1. An electric cut-out designed for use in connection with transformers and to prevent the continuation of open circuit secondary voltage conditions, comprising in combination, a transformer, a primary circuit, a cut-out switch in the primary circuit normally closed, and means whereby said switch will operate to break the primary circuit under the effect of continued open circuit voltage conditions in the secondary, substantially as set forth.

2. In an electric cut-out, the combination of a transformer operating under a normal voltage but intended to momentarily develop a voltage of abnormally high value, a primary circuit connected to the transformer, a normally closed cut-out switch in the primary circuit, and means whereby said cut-out switch will operate to open the primary circuit if an abnormally high voltage condition continues in the secondary circuit, said means being non-responsive to a momentary voltage rise, substantially as set forth.

3. In an electric cut-out, the combination of a transformer intended to operate at a normal voltage but momentarily developing a voltage of abnormally high value, a primary circuit, a normally closed switch in the primary circuit, and a fusible link co-operating with the secondary in the transformer so that a continued condition of abnormally high voltage will fuse said link and permit the cut-out switch to open the primary circuit, substantially as set forth.

4. In an electric cut-out, the combination of a transformer, secondary terminals there-

for, a primary circuit, a switch in the primary circuit, said switch being normally closed, and a fusible link normally holding the switch closed and having a spaced relationship, substantially as set forth, with respect to a secondary terminal of the transformer.

5. In an electric cut-out, the combination of a transformer, secondary terminals therefor, a primary circuit, a switch in the primary circuit, said switch being normally closed, and a fusible link normally holding the switch closed and having a spaced relationship, substantially as set forth, with respect to both secondary terminals of the transformer.

6. In an electric cut-out, the combination with a transformer, secondary terminals

therefor, a luminous tube in circuit with the secondary terminals, a primary circuit, a normally closed switch in the primary circuit, and a fusible link normally holding said switch closed and having a spaced relationship, substantially as set forth, with respect to said secondary terminals.

7. In an electric cut-out, the combination of a luminous tube, a transformer, secondary terminals for said transformer in circuit with the tube, a primary circuit, an electric switch in the primary circuit, said switch being normally closed, a trigger holding said switch normally closed, and a fusible link connected to said trigger and having a spaced relationship, substantially as set forth with respect to said secondary terminals.

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