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ELECTRICAL PROTECTIVE DEVICE

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Fig. 1.

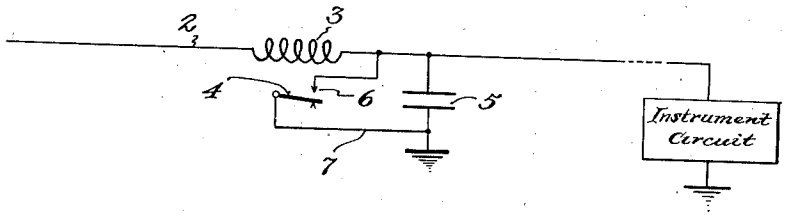
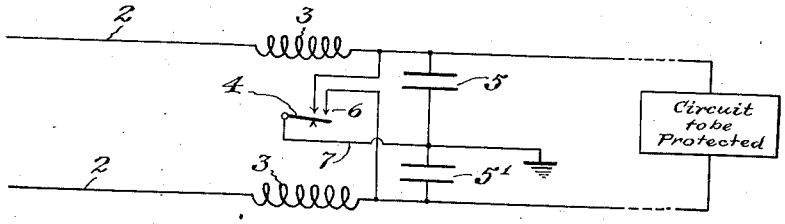


Fig. 2.



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ELECTRICAL PROTECTIVE DEVICE

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5 Claims. (Cl. 179—78)

This invention relates to devices employed for protecting electrical circuits, such as telegraph or telephone circuits, from disturbances arising from atmospheric disturbances, static discharges, or inductive interference from neighboring power circuits.

At the present time it is usual to ground the line or cable whenever disturbances due to lightning or other causes are appreciable. Certain types of lightning arresters employ spark gaps, sometimes associated with inductance devices and resistances for decreasing the amplitude and potential gradients of the disturbing waves and dissipating the excess energy stored in them. In other cases spark gaps are arranged in series with an electromagnetic device, such as a relay, for grounding the circuit when a spark passes, the protective devices automatically restoring themselves to their normal non-operated condition after an electrical discharge has taken place through them.

It is desirable to relieve the air-gap arrester promptly in case of a discharge therethrough by grounding the line to prevent the permanent short-circuiting of the arrester. It is desirable also in communication systems to protect the instruments against excessive current even though the excessive voltage between the instruments and the ground does not exceed the breakdown of the air-gap.

The object of our invention is to provide a protective device in which an air-gap exists at all times between the line and ground and having associated therewith, a magnetizing impedance operating upon a discharge through the air-gap to ground the line and also operating to ground the line upon the occurrence of an abnormal current insufficient to cause a discharge through the air-gap, or even from a voltage below the normal line operating line voltage in the event of a ground on the line wire at such a distance from the protective relay that a current through the latter will exceed a predetermined value.

Our invention will be clearly understood from the following description, read in connection with the accompanying drawing in which Figures 1 and 2 show schematically general forms of embodiments of the invention.

In Fig. 1 a magnetizing impedance, such as a relay coil 3, is placed in series with the line 2. An air-gap or other voltage valve 5 is connected between the line and ground at a point between the coil 3 and the instruments which it is desired to protect. An armature 4 is adapted to be operated by the flow of abnormal current through the coil 3 to engage contact 6 and shunt the line direct to ground. It is evident that this arrangement results in the operation of the armature 4 and consequent grounding of the line through the coil 3, contact 6 and conductor 7, whenever a discharge takes place through the air-gap 5. The relay thus performs the function of grounding the line and of preventing the permanent short-circuiting of the air-gap arrester. Hence when the disturbing voltage ceases the protective device is restored to normal position.

The coil 3 may be so proportioned and adjusted that any excessive or abnormal current flowing through the line will actuate the armature to close the ground through the contact 6, armature 4 and conductor 7 even though the voltage between the instruments and ground does not exceed the breakdown voltage of the air-gap 5. In this manner the relay may provide protection to the instruments against abnormal current which is equivalent to that provided by heat coils of the grounding type or to that provided by the usual standard fuses when used in circuits taking battery through a tap resistance, thereby making it unnecessary to provide a fuse between the air-gap connection and the instrument to be protected. The relay coil is preferably so designed that it will operate the armature on approximately the same amount of current usually required to operate the instrument fuses and will release as soon as the current through the coil decreases to approximately one-half of the current required to operate it.

In certain types of communication circuits, such as telephone and carrier telegraph circuits, the introducion of additional inductance, inherent in the relay coil is objectionable and to obviate this objection we have devised the arrangement disclosed in Fig. 2. The relay coils 3, 3′ have equal turns and are so poled as to oppose each other in the normal operation of the line operating currents and thus neutralizing any inductive effect in the metallic pair. Should the current through either coil become high enough, however, either due to operation of one of the air-gaps 5, 5′ or due to excessive current flowing in the line, the relay will operate to ground both lines 2, 2′ simultaneously. The ground is removed and the lines are restored to normal in the manner described in connection with Fig. 1.

We have shown and described different embodiments of our invention but it will be apparent to engineers that many modifications may be made within the spirit and scope of the appended claims.

We claim:

1. A line circuit exposed to interference, a circuit to be protected associated therewith, and a protective device comprising an electromagnetic element connected in series in the line, an air gap connected to the line between said element and the protected circuit to provide a path to ground for voltages exceeding a predetermined limit, and a second path to ground adapted to be closed by said element upon the occurrence of an abnormal current on the line.

2. A line circuit exposed to interference, a circuit to be protected associated therewith, and a protective device comprising an electromagnetic element connected in series in the line, an air gap connected to the line between said element and the protected circuit to provide a path to ground for voltages exceeding a predetermined limit, and a path in shunt to said air-gap adapted to be closed by said element upon the occurrence of an abnormal current on the line.

3. A line circuit exposed to interference, a circuit to be protected associated therewith, and a protective device comprising an electromagnetic element connected in series in the line, an air gap connected to the line between said element and the protected circuit to provide a path to ground for voltages exceeding a predetermined limit, and a second path to ground adapted to be closed by said element upon the occurrence of a current resulting from a voltage in excess of the normal operating line voltage but below said predetermined limit for the first named air-gap, said device being automatically restored to normal condition upon the decadence of the abnormal voltage.

4. A protective device for a signaling conductor, comprising a path to ground including an air-gap, a second path to ground including normally open contacts in shunt relation to said first named path, and an impedance element in series with the conductor responsive to current flow therein, said element operating magnetically to close said contacts upon the flow of an abnormal current in the conductor.

5. A line circuit exposed to voltages created by a source extraneous to the said line circuit, and a protective device comprising an air gap path connected between said line and ground, a second path between said line and ground, said second path including normally open contacts, and an electromagnetic element having two equal turn windings oppositely poled to neutralize any inductive effect due to normal operating line current, said windings being in series in opposite sides of said line circuit, said electromagnetic element operating to close said contacts upon the flow of an abnormal current in either side of the line circuit.

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