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ELECTRICAL PROTECTIVE SYSTEM

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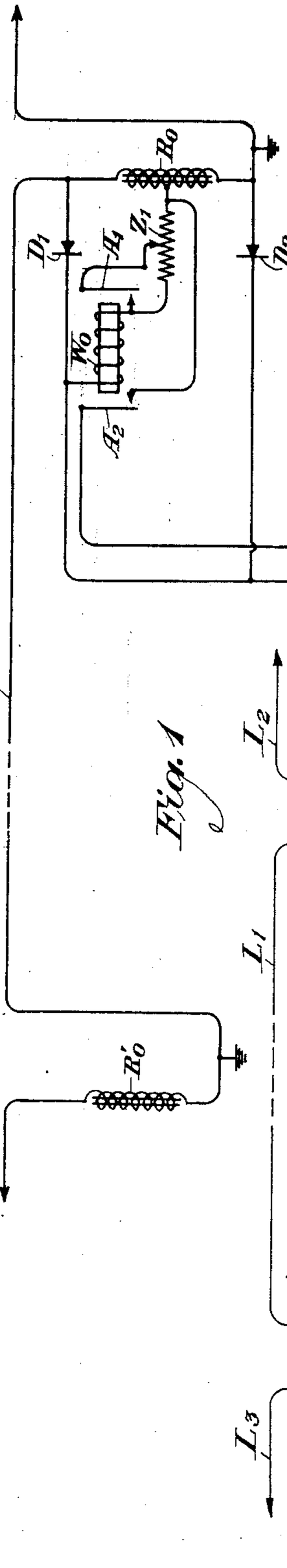

Fig. 1

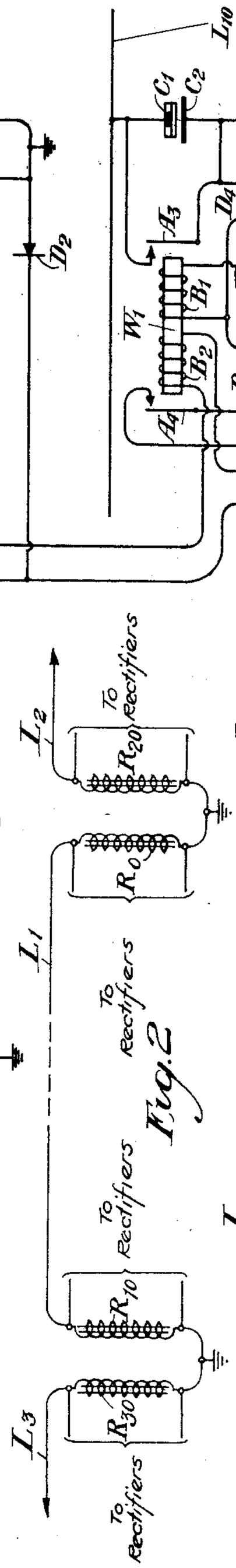

Fig. 2

Fig. 3

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ELECTRICAL PROTECTIVE SYSTEM

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This invention relates to electrical protective systems. More particularly this invention relates to arrangements for simultaneously grounding a plurality of circuits when induced voltages become impressed thereon.

A pair of protective blocks each having an air gap which breaks down at a predetermined potential have recently been used in the telephone art for the protection of each of a number of telephone circuits from high voltages set up therein by one or more sources extraneous to the circuits themselves. A resistor or a saturating reactor may be interposed in the ground connection of each pair of such protective blocks. The resistor or the reactor as the case may be, will carry the operating current of the two blocks associated therewith and the impedance drop across it may be rectified by a rectifier of, for example, the copper oxide type. The rectified current may be applied to a relay employed to shunt both protective blocks, in which event the induced current or currents will be carried through the heavy duty contacts of the relay.

A pluralty of pairs of protective blocks and a plurality of relays each corresponding to one of the pairs of the protective blocks, may be associated with a plurality of telephone circuits running substantially parallel to each other, each exposed to the same inductive effects. Apparently it will be possible to have a condition where some of the various relays will be operated and some unoperated, because the inductive effect may not be sufficiently large to cause all of the associated protective blocks to operate. This condition creates a great hazard since the circuits connected to the protective blocks and relays which have operated will be at ground potential, while the circuits connected to protectve blocks and circuits which have not operated will be at potentials considerably above ground.

One of the objects of this invention is to provide an arrangement for simultaneously grounding a plurality of circuits when an extraneous inductive effect becomes induced therein.

Another object of this invention is to associate a pilot wire with a plurality of circuits all of which are exposed to substantially the same inductive effects so that voltages extraneously impressed upon a resistor or a reactor located in the pilot circuit will cause the simultaneous grounding of all of the circuits.

While this invention will be pointed out with particularity in the appended claims, the invention itself will be better understood from the detailed description hereinafter following when read in connection with the accompanying drawings showing three figures embodying the elements of the invention which are given merely for the purpose of illustration.

Referring to Figure 1 of the drawings, the reference character L_1 designates a pilot wire which is divided into a plurality of sections only one of which will be considered in some detail hereinafter. The distant end will be grounded and the nearby end will also be grounded through a resistor or saturating reactor R_0. This section of the pilot wire may be grounded at, for example, two successive protector poles. It will be apparent that the reactor R'_0 will be part of another section of the pilot wire which may extend to a third protector pole. It will be further apparent that each reactor may be placed at or near the center of each section of the pilot wire, if desired.

When a nearby power circuit or other extraneous source induces a voltage in the pilot wire L_1, a current will be transmitted through the nearby reactor R_0, which will be utilized in this invention to simultaneously ground a plurality of circuits which may run parallel to each other and thereby obviate any electrical hazard resulting from the failure to ground any one of the various circuits.

The reactor R_0 is bridged by a circuit which includes two rectifiers D_1 and D_2 both of which may be of the copper oxide type. The conductor common to rectifiers D_1 and D_2 is connected to the midpoint of the reactor R_0 through the winding of a relay W_0 and a resistance Z_1. The relay W_0 includes two armatures A_1 and A_2 and these are normally released. Armature A_1 and its con-

tact are in shunt with a portion of resistance Z_1. Upon the operation of the relay W_0 the shunting of a portion of the resistance in series therewith will have the effect of increasing the flow of current therethrough, and this feature of the invention will be described in greater detail hereinafter.

One or more two-wire telephone circuits may be supported at each protector pole. Two such telephone circuits designated L_{10} and L_{20} are associated with the local protector pole, and one or more circuits each similar to the one designated L_{10} may be associated with the next successive protector pole. The apparatus associated with the circuit L_{10} will be described in some detail hereinafter merely for the purpose of illustration, although it will be understood that similar apparatus may be associated with each of the other circuits such as L_{20}, etc.

The circuit L_{10} is bridged by two protective blocks connected in series relationship. Each of these blocks includes two carbon electrodes spaced from each other by a gap of, for example, .005 inches. The electrodes forming one of these protective blocks will be designated C_1 and C_2, and those forming the other block will be designated C_3 and C_4. Each of the electrodes C_1 and C_4 may be supported in a porcelain holder which is so shaped as to insure the normal existence of a gap of predetermined width between the component electrodes.

The conductor common to the two protective blocks is connected to ground through a resistor or a reactor designated R_2, a reactor being selected for illustration. The reactor R_2 is bridged by a circuit including two rectifiers D_3 and D_4 which may, if desired, be of the same general type as rectifiers D_1 and D_2. A winding B_1 of an associated relay designated W_1 is connected between the midpoint of reactor R_2 and the conductor common to the rectifiers D_3 and D_4. The winding B_2 of this relay is in series with the armature A_2 and the associated contact of relay W_0. It is to be noted that the winding B_4 of a relay W_2 associated with the circuit L_{20} is also connected in series with the winding B_2 of relay W_1 and with the armature A_2 and the associated contact of relay W_0. It will be understood, however, that the corresponding windings of relays similar to W_1 which are located near other protector poles may be connected in series with winding B_2, if deemed necessary.

When an induced voltage of a predetermined magnitude or of greater magnitude becomes impressed upon the circuit L_{10}, an arc will be formed between the carbon electrodes C_1 and C_2 and between electrodes C_3 and C_4 of the two protective blocks associated with the circuit. The currents established through these protective blocks will be transmitted to ground through the reactor R_2. Opposite halves of the alternating voltage impressed across the reactor R_2 will be rectified, device D_3 rectifying, for example, the positive half of each cycle of the voltage, and the device D_4 rectifying the negative half of each cycle of the impressed voltage. It will then be apparent that a direct current will flow through the winding B_1 of relay W_1. Upon the operation of relay W_1 the armature A_3 of that relay will shunt the electrodes C_1 and C_2 of one of the protective blocks, while the armature A_4 will shunt the electrodes C_3 and C_4 of the other of these protective blocks. The contacts closed by armatures A_3 and A_4 of relay W_1 will be of heavy duty type so as to conveniently transmit large currents.

Thus, it will be apparent that the impression of an induced voltage upon circuit L_{10} will operate the two protective blocks associated with that circuit, thereby operating the relay W_1, and then the armatures A_3 and A_4 of relay W_1 will shunt these protective blocks. By preventing current from being continuously discharged through these protective blocks, the formation of irregularities upon the carbon electrodes thereof tending to reduce the size of the air gaps will be substantially reduced, and therefore these protective blocks will have longer life. It will be understood that the relay W_1 will be released when the previously induced voltage has disappeared.

The reactor R_0 located in series in the pilot wire L_1 and its associated circuits represent primary features of the invention employed for simultaneously grounding the circuits L_{10} and L_{20}. A voltage induced in the pilot wire L_1 will cause the impression of a corresponding voltage between the terminals of reactor R_0. Opposite halves of each cycle of the impressed alternating voltage will be rectified by rectifiers D_1 and D_2, and therefore a direct current will flow through the winding of relay W_0 and resistance Z_1 causing relay W_0 to operate. Inasmuch as the windings B_2 and B_4 of relays W_1 and W_2, respectively, are connected in series with the armature A_2 of relay W_0 and its contact, the closure of the latter contact will cause both of these relays to become simultaneously operated. Hence, the armatures A_3 and A_4 of relay W_1 will be attracted and these will connect the conductors connected to the carbon electrodes C_1 and C_4 of the two protective blocks associated with circuit L_{10} to ground through the reactor R_2. Thus, the circuit L_{10} will be effectively grounded. Similarly, the operation of relay W_2 will cause the effective grounding of the circuit L_{20}, the grounding circuit or circuits being similar to those associated with the circuit L_{10}.

Inasmuch as the armature A_1 of relay W_0

closes its associated contact just as soon as the armature A_2 of that relay closes its contact, a substantial portion of the resistance Z_1 will be shunted so that a greater current may tend to flow through the winding of relay W_0. Under any other conditions the rectified current provided by rectifiers D_1 and D_2 may not be sufficient to operate relays W_1 and W_2 and maintain these relays operated.

While the windings B_2 and B_4 have been shown as connected in series relationship with the armature A_2 of relay W_0 and its contact, it will be understood that these windings and other similar windings, may be connected in parallel relationship, or that some may be in series relationship and other in parallel relationship, within the scope of this invention.

Fig. 2 of the drawings represents a modified arrangement for obtaining the simultaneous grounding of a plurality of circuits which may run parallel to each other. Here each section of the pilot wire includes two reactances, one located at each protector pole. Thus, the reactors R_0 and R_{10} are located in series with the section of the pilot wire designated L_1 at distant ends thereof, which are grounded. The reactor R_{20} is connected to the section of the pilot wire designated L_2 which extends to a distant protector pole, while the reactor R_{30} is connected in series with the section of the pilot wire designated L_3 which extends to a more distant protector pole. The terminals of each of the various reactors R_0, R_{10}, R_{20} and R_{30} are connected in a circuit which includes a pair of copper oxide rectifiers similar to those designated D_1 and D_2 in Fig. 1 of the drawings, and, moreover, a master relay and a resistance similar to those respectively designated W_0 and Z_1 in Fig. 1 of the drawings, are connected to each of the various reactors.

The object of the arrangement shown in Fig. 2 is to cause the simultaneous grounding of the various circuits at any particular protector pole when an extraneous voltage is impressed upon either section of the pilot wire terminating at that particular protector pole. Thus, it is proposed to have the various relays associated with the corresponding circuits supported by any protector pole become simultaneously grounded if an induced voltage flows through either of the two reactors such as R_0 and R_{20} which are connected to circuits forming part of the equipment at that protector pole.

It will be apparent from Fig. 3 that a relay W_3 similar to the one designated W_1 in Fig. 1, but having three properly poled windings designated B_5, B_6 and B_7, will be needed for each circuit requiring protection. One of these windings, i. e. B_5, will be connected to the two copper oxide rectifiers, such as D_3 and D_4 of Fig. 1, forming part of the equipment for locally protecting one of the various circuits which may become exposed to extraneous voltages, another, i. e. B_6, will be connected in series with the two parallel rectifiers D_1 and D_2 bridging the reactor in one section of the pilot wire, and the third, i. e. B_7, will be connected in series with the parallel rectifiers D_5 and D_6 bridging the reactor in series with another section of the pilot wire.

While this invention has been shown in one particular embodiment merely for the purpose of illustration, it will be understood that the general principles of this invention may be applied to other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. The combination of a plurality of circuits exposed to extraneous inductive effects, a pilot wire exposed to the same inductive effects, an impedance in series with said pilot wire, and means including rectifying apparatus extending from said impedance to said circuits and responsive to a substantial extraneous inductive effect for simultaneously grounding all of said circuits.

2. The combination of a plurality of circuits exposed to extraneous inductive currents, a pilot wire exposed to the same inductive currents, a reactor in series with said pilot wire, and means including a pair of rectifiers extending from said reactor to said circuits and responsive to a substantial extraneous inductive current for simultaneously grounding all of said circuits, said rectifiers rectifying opposite halves of each cycle of the inductive current.

3. The combination of a plurality of circuits, a plurality of protective blocks one associated with each of said circuits, said protective blocks being employed to ground the various circuits when an extraneous voltage becomes impressed thereon, a pilot wire exposed to the same extraneous voltage, and means responsive to any extraneous voltage impressed on the pilot wire for simultaneously grounding all of said circuits independently of said protective blocks.

4. A system for simultaneously grounding all of the circuits extending over protector poles when a high voltage from one or more extraneous sources becomes impressed on the system, comprising a pilot wire grounded at each end, a resistor connected in series with said pilot wire, two rectifiers connected in a circuit in shunt with said resistor, said rectifiers being poled so as to rectify opposite halves of any alternating voltage impressed upon said resistor, a plurality of relays one associated with each of the various circuits, and means interconnecting the various relays with said rectifiers for simul-

taneously operating said relays when a substantial alternating voltage is impressed across said resistor.

In testimony whereof, I have signed my name to this specification this 20th day of August, 1930.

LIVINGSTON P. FERRIS.