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PROTECTIVE AND ALARM SYSTEM

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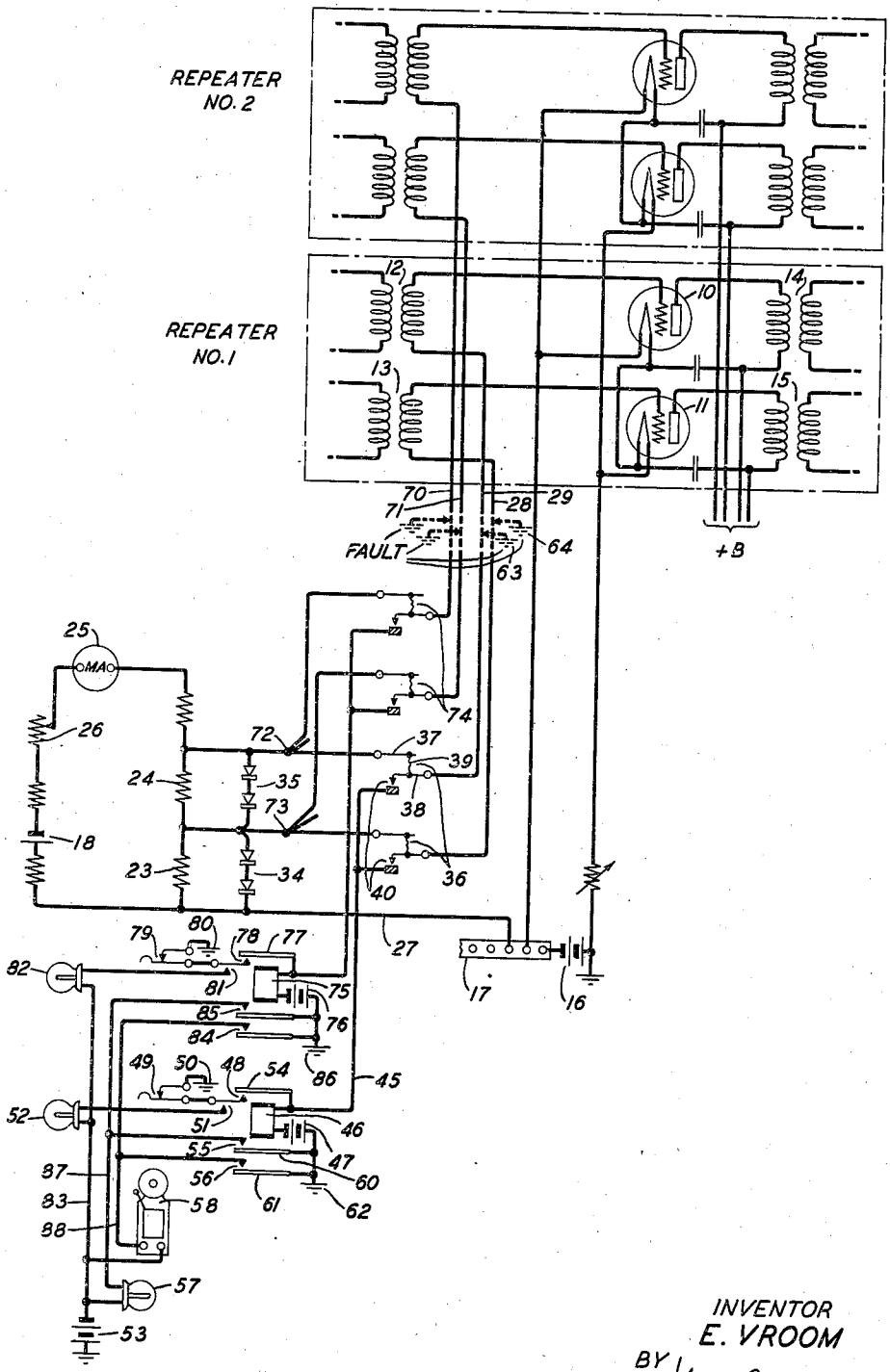

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PROTECTIVE AND ALARM SYSTEM

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6 Claims. (Cl. 179—170)

This invention relates to protective circuits and more particularly to a safety and alarm arrangement for telephone repeaters.

In the operation of thermionic repeaters from a common grid potential supply heretofore, one difficulty encountered has been the trouble occasioned by an inadvertent grounding of grid leads. To clear this it has been necessary to remove from service a group of repeaters, and test the several grid leads associated therewith to isolate the defective one. This required not only auxiliary repeaters for emergency use but also involved the loss of a repeater group for an extended period due to the considerable time consumed in hunting the nature and source of the trouble.

It is an object of this invention to provide an arrangement for thermionic repeaters operating from a common grid-potential supply that will quickly indicate a fault and its location.

In a preferred embodiment, the invention comprises copper-oxide rectifiers bridged across the grid impedances of the common grid-supply circuit. The rectifiers poled against the flow of grid current connect the grid leads, each of which embodies a current-responsive means, and a common filament battery. An accidental ground occurring on a grid lead draws adequate current from the filament battery to actuate the current-responsive means. This operates a signaling circuit which includes an audible alarm and an indicator showing the nature and location of the trouble.

The invention will be readily understood from the following description taken together with the accompanying drawing which is a circuit diagram showing the invention employed with a plurality of repeaters.

The drawing is a portion of the system for energizing and testing repeaters disclosed in the patent of E. Vroom No. 1,616,156, issued February 1, 1927.

Referring to the drawing, repeater No. 1 is represented as comprising electron discharge devices 10 and 11, each of which includes a control grid and a cathode, input transformers 12 and 13, and output transformers 14 and 15. Cathode heating current is supplied from a common 24-volt battery 16 which has its negative terminal connected to a negative bus-bar 17 and its positive terminal to ground.

Grid potential is obtained from a common grid-supply circuit comprising a 10-volt grid battery 18, impedances 23 and 24, milliammeter 25, and rheostat 26. A link 27 joins the positive terminal of impedance 23 and the negative bus-bar 17. Potentials developed across the impedances 23 and 24 are supplied over leads 28 and 29, respectively, to the grids of the electron discharge devices. Normally, no current flows on these leads.

Milliammeter 25 serves to indicate the magnitude of current flowing through impedances 23 and 24. It is understood that this current is to be maintained at a predetermined value so that substantially constant potentials will be produced across the impedances 23 and 24. A more detailed description of the circuit including the requisite regulatory apparatus may be had by referring to the Vroom patent, supra.

In a preferred embodiment of this invention, copper-oxide rectifiers 34 and 35 are bridged across the impedances 23 and 24, respectively. The rectifiers are so poled that normally no current from grid battery 18 will flow therethrough. The number of rectifiers included in each bridge will depend on the operating conditions for a particular circuit. It is understood that other means restricting current flow to one direction may be substituted for the copper-oxide rectifiers.

Fuses 36, 36 connected in the grid leads 28 and 29 are of a type disclosed in the patent of M. C. Rorty et al. No. 761,916, issued June 7, 1904. Each of these comprises a terminal 37 and a tongue 38 flexed by a fuse-link 39. The tongue 38, when retracted due to a rupture of the fuse-link 39, is adapted to engage contact 40. The contacts 40, 40 of the two fuses 36, 36 are connected by a lead 45 to one terminal of the winding of an alarm relay 46. The opposite terminal of this winding is connected to battery 47. Relay 46 is normally unoperated, hence its associated contacts are normally open. It is understood that a relay or circuit breaker having a relatively low alternating current impedance, or similar current-responsive device, may be substituted for the fuses 36, 36.

Contact 48 is connected through a key 49 to ground 50, and contact 51 is connected through a signal lamp 52 to battery 53. Both of these contacts are associated with armature 54 which is directly joined to the lead 45. Contacts 55 and 56 are connected through a lamp 57 and a bell 58, respectively, to the battery 53. These contacts are associated with armatures 60 and 61, both of which are grounded at 62.

In operation, let it be assumed that an accidental ground indicated at 63 occurs on lead 29. Current will flow from cathode battery 16 through ground 63, tongue 38, fuse-link 39, ter-

minal 37, lead 29, rectifiers 35 and 34, link 27, to the common negative bus-bar 17. Adequate current will flow in this circuit to burn-out the fuse link 39. This causes the flexed tongue 38 to retract sufficiently to engage contact 40.

A circuit is now established to energize relay 46. This comprises ground 63, tongue 38, contact 40, lead 45, winding of relay 46, and battery 47. Relay 46 operates, thereby actuating armature 54 to close the contacts 48 and 51. Relay 46 is locked up by a circuit consisting of battery 47, winding of relay 46, armature 54, contact 48, key 49, and ground 50. At the same time, the filament of signal lamp 52 is energized by a circuit including battery 53, filament of lamp 52, closed contact 51, key 49, and ground 50. Signal lamp 52 indicates that the ground occurred on repeater No. 1.

Also, when alarm relay 46 is operated, the armatures 60 and 61 are actuated into engagement with the contacts 55 and 56, respectively. This energizes the alarm bell 58 and the filament of lamp 57 through circuits comprising ground 62, the respective contacts associated with the armatures 60 and 61, lead 83, and battery 53. Bell 58 rings to call attention to the occurrence of a trouble while the lamp 57 indicates that the trouble involves the grid lead of a repeater. As previously pointed out, lamp 52 identifies the particular repeater, or group of repeaters as the case may be, on which the fault occurred.

As shown in the drawing, lamp 52 is connected to indicate a ground on either grid lead 28 or 29 of repeater No. 1. The blown fuse will indicate the particular lead of these two on which the ground occurred. It is obvious that the circuit may be so designed that relay 46 and an indicating lamp 52 would be individual to each grid lead.

When a ground shown at 64 occurs on the grid lead 28, the operation of the signaling circuit will be the same as that aforedescribed in response to a similar fault on grid lead 29.

After the ground is cleared and the burnt-out fuse is replaced, key 49 is operated to interrupt the locking circuit for relay 46. Thereupon, this relay becomes deenergized and the signaling circuit controlled thereby is returned to normal.

It is further seen in the drawing that leads 70 and 71 connected to the common grid-supply circuit at the points 72 and 73, respectively, are utilized to energize the control grids of repeater No. 2. It is understood that the latter comprises the same apparatus shown and described above in connection with repeater No. 1. It is also evident that the grids of additional repeaters may be energized from the common grid supply circuit by tapping their respective leads to the points 72 and 73.

Current-responsive devices 74, 74 embodied in the grid leads 70 and 71 are duplicates of the devices 36, 36 both with regard to their structure and operation. Therefore, an inadvertent ground occurring on either grid lead 70 or 71 will cause the respective current responsive device to burn-out and operate, thereby completing an energization circuit for alarm relay 75 whose winding is connected to battery 76. This relay operates and locks-up through a circuit comprising battery 76, winding of relay 75, armature 77, contact 78, key 79, and ground 80.

Since contact 81 is now closed, the filament of signal lamp 82 is energized in a circuit including battery 53, lead 83, the filament of lamp 82, contact 81, key 79, and ground 80. Signal lamp 82 indicates that the accidental ground occurred on one of the two grid leads associated with repeater No. 2. The blown fuse isolates the particular one of these two on which the accidental ground occurred.

Also, the operation of alarm relay 75 effects the closing of contacts 84 and 85 to establish energization circuits for the common signal lamp 57 and the common alarm bell 58. The energization circuit for the signal lamp 57 includes ground 86, closed contact 85, lead 87, the filament of lamp 57, lead 83, and battery 53. The energization circuit for the alarm bell 58 embodies ground 86, closed contact 84, lead 88, bell 58, lead 83, and battery 53.

Thus, again, bell 58 announces the occurrence of a fault while the lamp 57 indicates the latter as involving the grid leads of one of several repeaters. As previously pointed out, signal lamps 52 and 82 identify the particular repeater on which the fault occurred. After the blown-out fuse 74 is replaced and the accidental ground is removed from the grid lead 70 or 71, the signaling circuit associated with repeater No. 2 is restored to normal by deenergizing the alarm relay 75. This is accomplished by operating the key 79 to interrupt the holding circuit for this relay.

The number of repeaters included in a group energized from the common grid-supply circuit is, of course, determined by the efficiency at which it is desired to operate the individual repeaters. Inasmuch as the number may, in some cases, exceed two, it is obvious that the signaling circuit can be readily adapted to accommodate any number of repeaters. In this connection each repeater may have its individual signal lamp and, in addition, be operatively connected with the common signal lamp 57 and the common alarm bell 58.

In the event of operating the repeaters in conjunction with a telephone central office, the signaling circuit associated with the repeaters lends itself readily for combination with the central office alarm apparatus. Thus, the common alarm bell 58 may become the all-purpose alarm of the central office, and the common lamp 57 may be incorporated as indicating one type of fault in a group indicator. The latter may be a drop, or other suitable type, many of which are well known in telephone practice. The individual signal lamps should, of course, be located as close to the repeaters as local conditions will permit. A preferred location would be the relay rack on which the repeaters are mounted.

It is understood that the signaling circuit illustrates one simple form and further, that other signaling apparatus may be substituted if desired. Furthermore, it is apparent that the signaling circuit may be modified in a manner that eliminates the individual lamps 52 and 82, and utilizes only the general lamp 57. In this event, the blown fuse would identify the particular grid lead and, in addition, the repeater on which the ground occurred.

What is claimed is:

1. In combination, an electron discharge device including a control grid and a cathode, a grid-potential circuit comprising a source of current and an impedance, a source of current for energizing the cathode, a lead connecting the impedance and the control grid, means bridging the impedance and restricting current flow therethrough to one direction for joining the control-grid lead and the cathode source of current, and current-responsive means in the lead connecting

the impedance and control grid to effect an interruption thereof.

2. A combination according to claim 1 in which the bridging means is a copper-oxide rectifier poled against the source of current flowing in the grid-potential circuit.

3. In combination, an electron discharge device including a control grid and a cathode, a grid-potential circuit including a source of current and an impedance, a source of current for energizing the cathode, a lead joining the impedance and control grid, a copper-oxide rectifier bridged across the impedance and poled against the current in the grid-potential circuit for connecting the grid lead and the cathode source of current, current-responsive means for interrupting the grid lead, and signal means responding to the interruption for announcing its occurrence.

4. In combination, in a repeater comprising a pair of electron discharge devices each of which includes a control grid and a cathode, a common grid circuit embodying a source of current and a plurality of impedances, a common source of current for energizing the cathodes, leads connecting the impedances and the control grids, means bridging the impedances and restricting current flow therethrough to one direction for joining the control-grid leads and the cathode source of current, and means responsive to current in the control-grid leads for disconnecting the control grids from the impedances.

5. A combination according to claim 4 in which the bridging means are copper-oxide rectifiers, and which includes a signaling means associated with the control-grid leads and operatively responsive to the interruption for indicating its occurrence.

6. In combination, a plurality of repeaters each comprising a pair of electron discharge devices, each of the latter including a control grid and cathode, a common grid circuit embodying a source of current and a plurality of impedances, a common source of current for energizing the cathode, leads connecting the impedances and the control grids of the repeaters, a copper-oxide rectifier bridging each impedance and poled against the flow of current in the common grid circuit for connecting the control-grid leads to the cathode source of current, means in each control-grid lead to respond to current flow therein for disconnecting the respective grid leads from the common grid circuit, and signaling means operatively responsive to the interruption for announcing the occurrence of the latter and identifying the repeater on which it happened.

EDWARD VROOM.