

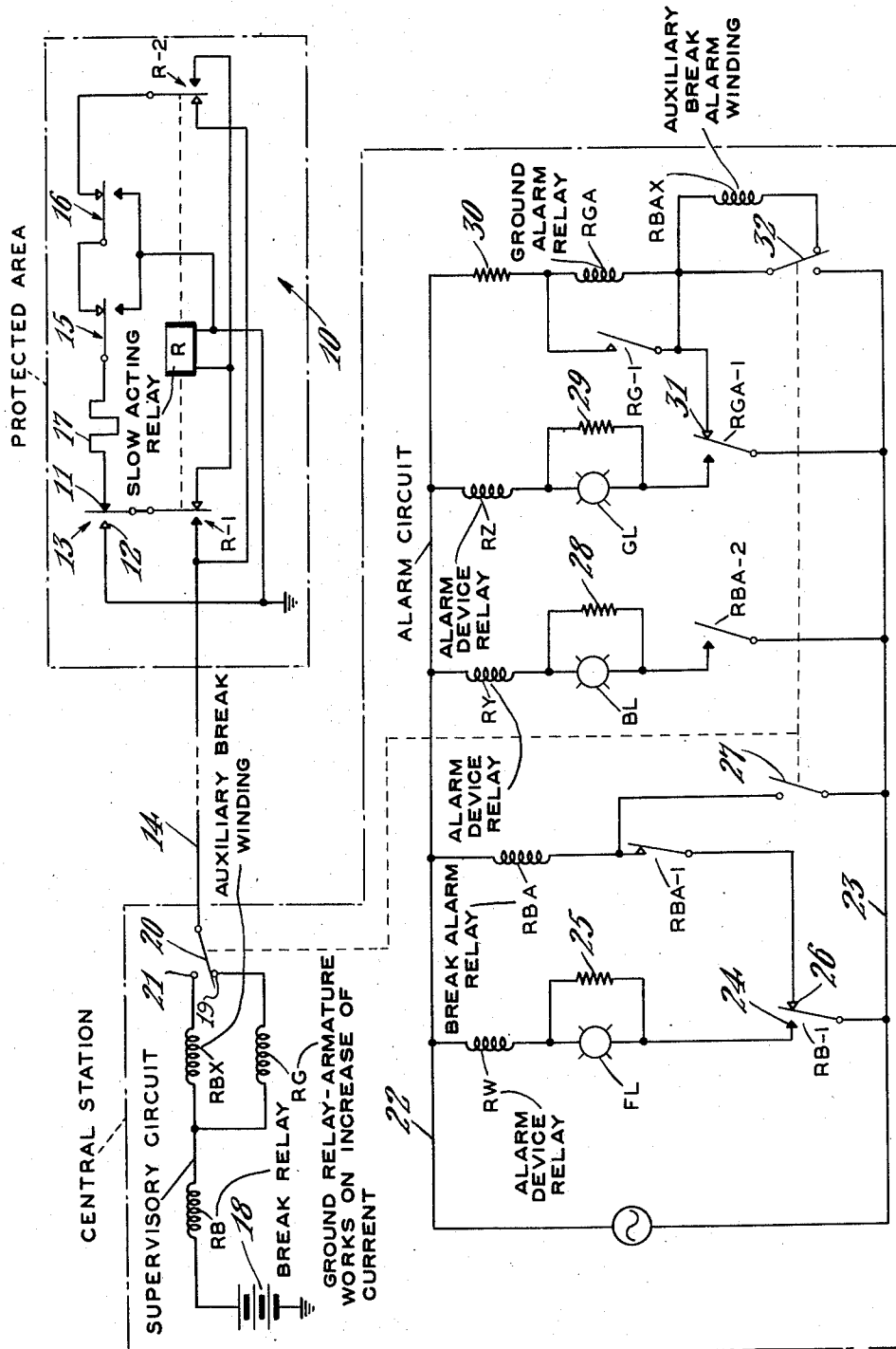
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BURGLAR ALARM SYSTEM WITH EQUAL DAY AND NIGHT CURRENT

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BURGLAR ALARM SYSTEM WITH EQUAL DAY AND NIGHT CURRENT

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My present invention relates to protection systems and more particularly to burglar alarm systems in which a local circuit at an area to be protected is joined to a supervisory circuit at a central station where relays in response to changes in the flow of current along the line joining the central and local circuits effect the operation of various signalling devices.

In the operation of such systems even though there may be periods when protection is not required it is desirable to maintain a flow of current along the line joining the central and local protection circuits in order to detect and permit timely repair of circuit failures, should such occur. Under such conditions, commonly termed day or protection-off, with the protection circuit cut out of the line, the current drain on the power source is usually greater than during the night or protection-on condition. This variation in day and night current is undesirable especially when a battery is utilized as the source.

It will be readily appreciated that in order to perform the function of providing protection against intrusion into a protected area, alarm signals must be acted upon promptly. Consequently, the occurrence of spurious signals which cannot be distinguished from an alarm signal is objectionable as they add to the cost of or interfere with maintaining the desired protection service.

It is, therefore, a principal object of this invention to provide a supervisory circuit especially suitable for use in burglar alarm systems whereby protection-off current drain normally does not exceed that of the protection-on condition of the system.

Another object is the provision of such a system in which the protection-off current drain does not exceed that of the protection-on condition of the system and in which transient current surges or other short duration occurrences are ineffective and do not cause transmission of spurious signals.

Additional objects as well as advantages of this invention will be apparent from the following description and the accompanying drawing which is a diagrammatic view of a system arranged in accordance with this invention.

Referring now to the drawing in detail, a conventional protection circuit 10 such as may be utilized at a protected area has two terminals, one of which is connected to ground while the other is connected to transmission line 14, extending between the protected area and a central station. Protection circuit 10 may include relay R governing contacts R-1 and R-2 as well as switches 15, 16 forming part of well-known detection devices and resistance element 17 in the form of a metal foil or the like. Relay R may be a slow-release type relay as set forth in my copending application, filed simultaneously herewith, and assigned to the assignee of this application. Switches 15 and 16 may be associated with a door or window, opening of which serves to operate the same. The foil represented by element 17 may be mounted on the glass of a window or door and, as is well known, is broken when the glass is broken, thereby interrupting flow of current therethrough.

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A day-night switch 13 has a night terminal 11 and a day terminal 12 and as shown in the drawing, is in its right-hand or protection-on position. Line 14 serves to connect protection circuit 10 which now includes the resistance of relay R to the supervisory circuit at the central station. During the daytime or protection-off condition, switch 13 is operated so as to open the circuit of relay R and to connect line 14 to grounded contact 12. It is obvious that during the protection-off period the resistance included in the circuit with line 14 is reduced by at least the value of the resistance of relay R. Again, with protection circuit 10 in its protection-on condition, operation of any one of the protection devices also results in opening the circuit of relay R.

The supervisory circuit comprises relays RB and RG connected in series between one side of battery 18 and contact 19 of switch 20. As will be more fully pointed out, an auxiliary winding is connected in series between winding RB and contact 21 of switch 20. Relays RB, RG and R are selected such that with the switches in the position shown relay RB is energized and holds its armature in its attracted position while the amount of current flowing, relay R being energized, is below that required to energize relay RG and its armature is released. However, when the resistance of relay R is removed from the circuit as when switch 13 is in its left-hand position and after relay R has released, sufficient current flows to energize relay RG to attract its armature. Thus, the resistance of relay R when in series with relays RB and RG limits the current flow therethrough to a value which is sufficient to maintain relay RB energized but which is insufficient to fully energize relay RG to pick up.

Protection circuit 10 includes two loops, one corresponding to the protection-on condition with relay R energized, as shown, and included in series with relays RB and RG. Upon operation of either of the protection devices or the day-night switch 13 relay R is deenergized and its armature shifts its contacts R-1 and R-2 so that the other loop of the protection circuit is then in circuit with line 14 and relays RB, RG. Assuming that switch 15 has been actuated due to operation of the protection device associated therewith, the circuit may be traced as follows: Line 14 is connected through the back contact of contact R-1, relay R having deenergized and the armature of contact R-1 having been shifted to the left as viewed. The ground connection is completed through switch contacts 13 and 11 and through resistance element 17 in series with switch 15 now in its down position, having been actuated and completing a circuit to ground. The winding of relay R is now no longer in circuit with relays RB and RG with the result that there is an increase in the flow of current through relay RG causing the latter to attract its armature and pick up.

The alarm circuit includes suitable components such as relay windings RW, RY and RZ which may form alarm relays which, when energized, actuate suitable annunciators or other alarm devices as may be desired. Relays RW, RY and RZ are connected in parallel across a suitable source as indicated and their manner of control will now be described.

For simplicity the contacts governed by the various relays are designated by the same letters used to identify the corresponding relay with a numeral suffix added. In the drawing, the front contacts, those engaged with the armature attracted, are shown in outline while the back contacts which are engaged when the armature is released are indicated in solid black.

One side of relay RW is connected to conductor 22 while the other side thereof is connected to back contact 24 of contact RB-1 through lamp FL and resistor 25 shunting the same. Relay RBA is a break alarm relay which is normally maintained energized and, as will be

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more fully pointed out, is deenergized, to signal the occurrence of a break. Relay RBA is connected on one side to conductor 22 and on the other side through its normally closed contact RBA-1 to the front contact 26 of contacts RB-1. The arm of contacts RB-1, governed by relay RB, is connected to conductor 23. Switch 27 is connected between relay RBA and conductor 23 and when closed connects the relay directly to conductor 23 thereby shunting contacts RBA-1 and RB-1. Relay RY, a second alarm device operating relay, is also connected between conductors 22 and 23 through a resistor 28 in shunt with lamp BL and normally open contacts RBA-2. Relay RZ is a third alarm device operating relay connected between conductors 22, 23 through a resistor 29 in shunt with lamp GL and the normally open back contacts of contacts RGA-1.

Ground alarm relay RGA, shunted by normally open contacts RG-1 of ground signal relay RG, is connected to line 22 through a suitable resistor 30 and to conductor 23 through the normally closed front contact 31 of its own contact RGA-1. An alternate current path for relay RGA is provided through one position of switch 32 the other position of which serves to short-circuit auxiliary relay winding RBAX which is located physically in proximity with the winding of relay RBA so as to affect the operation of its armature, as will be described.

With the circuits energized for normal protection-on service and in the absence of a break or a ground impulse, relay RB holds its armature attracted while that of relay RG is released. Relay RBA is energized through its own contacts RBA-1 and through the front contacts 26 of contacts RB-1 governed by relay RB. Relay RGA is also energized, the circuit being completed through its own front contacts 31 of contacts RGA-1 while contacts RG-1 governed by relay RG are open.

Signals may be provided as follows: Assuming a physical break in line 14 during which the line is not grounded, current through relay RB will decrease, causing it to drop out. This action will also occur in the interval between operation of any one of the alarm devices in the protected area and the establishment of a ground condition after release of relay R. When line 14 is grounded either through manual operation of switch 13 or operation of an alarm device contact such as 15 after deenergization of relay R, the current flow through relays RB and RG increases to a value sufficient for ground relay RG to attract its armature.

When a subscriber at the protected area shifts switch 13 to engage its grounded contact 12 to place the system in its day or protection-off condition, a momentary break impulse is transmitted, thereby deenergizing relay RB for a short interval, and contacts RB-1 are shifted momentarily. But due to the fact that auxiliary relay winding RBAX is short-circuited at this time, relay RBA is slow to release making it unresponsive to short spurious breaks. However in this case the break condition lasts until relay R drops out. This relay is of the slow release type and its delay is sufficiently long to allow relay RBA to deenergize. Back contact RBA-2 energizes lamp BL and alarm relay RY. Lamp FL and alarm relay RW are only momentarily energized through back contact RB-1 until relay RB is reoperated by the ground through switch contact 12. However, relay RBA remains deenergized until the operator at the central station momentarily closes switch 27. This deenergizes lamp BL and alarm relay RY. On completion of its excursion and after release of relay R switch 13 grounds line 14, the back contact of R-1 now being closed, and the increased current flow energizes relay RG, which then closes its contacts RG-1 to short-circuit relay RGA. As shorted, relay RGA is also slow to release but, since the condition persists, relay RGA releases its armature, thereby shifting its contacts RGA-1 to the left, locking itself out and closing the circuit to relay RZ and lamp GL. Shifting of switch 13 is done at a prearranged time or otherwise so

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that its operation in the manner just described provides a signal to the operator at the central station indicating that the system is to be on day service. The operator now shifts switch 20 into engagement with its contact 21 and switch 32 to open the short-circuit across winding RBAX and connect relay RGA to conductor 23. Relay RG is now once again deenergized since its winding is out of the circuit and contacts RG-1 open, removing the short circuit from relay RGA. Consequently relay RGA is reenergized through switch 32 and locks itself in through contacts RGA-1. It should be noted that switch 20 is preferably a make before break type switch so that at no time does operation thereof affect the condition of relay RB.

The circuits are now in the day or protection-off condition and auxiliary winding RBX is in series with relay RB. The resistance of auxiliary winding RBX is chosen so that when added to that of relay RB the current drain on battery 18 does not exceed that when relay R is in circuit therewith. Consequently, the protection-off current drain does not exceed that characteristic of the protection-on current drain. Auxiliary winding RBX is mounted so as to add to the holding power of relay RB, thereby reducing the value of current below which it releases its armature.

Before describing the operation of the system in response to impulses incidental to placing the system into protection-on service and those which signal an attempted intrusion into the protected area, a preferred relationship of switches 20, 27 and 32 will now be set forth. These switches are physically coupled so that they may be operated by a common switch member which in its middle position sets switches 20, 27 and 32 as shown in the drawing. When the common switch member is moved to one extreme position, switch 27 is left undisturbed while switch 20 is raised and switch 32 shifted to the left as previously described in connection with protection-off service. In order to close the portion of the switch means represented by switch 27, the common switch member must be moved through its middle position to its other extreme position. Therefore, switch 27 can only be closed when switches 20 and 32 are in the positions shown and in particular only when relays RB and RG are connected in series. Furthermore, during day service relay RGA continues to be slow to release, while with winding RBAX open circuited relay RBA releases without a delay period.

To restore the system to protection-on service the subscriber at the protected area shifts switch 13 to open contact 12 and close contact 11. Even though the added resistance of relay R is now included in circuit with relay RB and its auxiliary winding RBX, relay RB continues to hold its armature attracted with the aid of winding RBX. The rate of current flow will be below the night rate until switch 20 is restored to its protection-on position. In shifting switch 13 from contact 12 to contact 11 only a short momentary break is transmitted. However, because winding RBAX is not shunted at this time relay RBA releases giving the alarm. Operation of switch 20 also restores switch 32 to the position shown in the drawing while switch 27 remains undisturbed.

Relay RB with or without auxiliary winding RBX follows all break signals represented by an interruption in the current flow and consequently lamp FL and winding RW do the same, since their circuit is governed by contacts RB-1. On the other hand, relay RBA with auxiliary winding RBAX short-circuited responds only to those break signals which are of longer duration than the delay period provided by winding RBAX. Similarly, relay RGA which is short-circuited due to closing of contacts RG-1 upon energization of relay RG responds only to those ground signals or increases in current flow which are of longer duration than the time required for decay of the field of winding RGA.

With the system as represented in the drawing and assuming that an intruder causes operation of switch 15,

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relay RB will first respond to the break signal which persists only for the time required for relay R to ground line 14. This break signal will be picked up by energization or flashing of lamp FL and due to the action of relay RW. Due to the long drop-out delay of relay R relay RBA releases despite the short-circuit condition of auxiliary winding RBAX. Upon grounding of line 14 due to release of relay R, the increase in current flow serves to energize relay RG to attract its armature and close contacts RG-1, short-circuiting relay RGA. Relay RGA drops out, since this condition persists longer than its delay period, closing the circuit of the ground alarm relay RZ and lamp GL through its contacts RGA-1.

If for any reason current flow along line 14 should be interrupted for an interval longer than the delay period of relay RBA with winding RBAX short-circuited, relay RBA will drop out and by opening its contacts RBA-1 will lock itself out. Break lamp BL and relay RY are energized due to closing of contacts RBA-2. The circuit can be restored by the operator operating switch 27 and reenergizing relay RBA. Contacts RBA-2 open upon energization of relay RBA to deenergize break lamp BL and relay RY. When the break is cleared relay RB will once again be picked up, shifting its contacts RB-1 to the position shown in the drawing.

Transient or short duration impulses which may serve to deenergize relay RB or energize relay RG are ineffective to cause operation of the corresponding alarm relays. One cause of such transient impulses may be a momentary drop in current flow which persists long enough to cause release of relay RB. Such conditions during protection-on service would initiate a spurious break alarm signal in the absence of shorted winding RBAX. Momentary current surges which may have sufficient amplitude to energize relay RG are ineffective to cause initiation of a ground alarm signal so long as their duration is less than the delay period introduced by short-circuiting relay RGA.

The terms and expressions which I have employed are used as terms of description and not of limitation, and I have no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof, but recognize that various modifications are possible within the scope of the invention claimed.

What is claimed is:

1. In an electrical burglar alarm protection system in which a protection circuit at a protected area normally having a predetermined resistance is electrically coupled to a remote supervisory circuit at a central station during protection-on service, said supervisory circuit comprising first and second relays in series with a source of electromotive force, said first relay being responsive to decrease in current therethrough below a predetermined lower value, said second relay being responsive to increase in current therethrough above a predetermined upper value, means at the protected area for selectively connecting said supervisory circuit in series with said protection circuit to provide protection-on service and to connect said supervisory circuit to ground to provide protection-off service, an auxiliary winding having a resistance substantially equal to said predetermined resistance and coupled with the armature of said first relay, and means at said central station for connecting said first relay in series with said auxiliary winding during protection-off service.

2. In an electrical burglar alarm protection system in which a protection circuit at a protected area normally having a predetermined resistance is electrically coupled to a remote supervisory circuit at a central station during protection-on service, said supervisory circuit comprising first and second relays in series with a source of electromotive force, said first relay being responsive to decrease in current therethrough below a predetermined lower value, said second relay being responsive to increase in current therethrough above a predetermined upper value, means at the protected area for selectively connecting said

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supervisory circuit in series with said protection circuit to provide protection-on service and to connect said supervisory circuit to ground to provide protection-off service, an auxiliary winding having a resistance substantially equal to said predetermined resistance and coupled with the armature of said first relay, an alarm circuit governed by said supervisory circuit and including a break alarm relay and contact means governed by said first relay for normally maintaining said break alarm relay energized, and means at said central station for selectively connecting said first relay in series with said auxiliary winding and opening the circuit of said second relay during protection-off service and for energizing said break alarm relay independently of said contact means only when said first and second relays are connected in series.

3. In an electrical burglar alarm protection system in which a protection circuit at a protected area normally having a predetermined resistance is electrically coupled to a remote supervisory circuit at a central station during protection-on service, said supervisory circuit comprising first and second relays in series with a source of electromotive force, said first relay being responsive to decrease in current therethrough below a predetermined lower value, said second relay being responsive to increase in current therethrough above a predetermined upper value, means at the protected area for selectively connecting said supervisory circuit in series with said protection circuit to provide protection-on service and to connect said supervisory circuit to ground to provide protection-off service, an auxiliary winding having a resistance substantially equal to said predetermined resistance and coupled with the armature of said first relay, an alarm circuit governed by said supervisory circuit and including a break alarm relay and contact means governed by said first relay for normally maintaining said break alarm relay energized, a second auxiliary winding coupled with the armature of said break alarm relay, means for maintaining said second auxiliary winding short-circuited during protection-on service with said first and second relays connected in series, and means at said central station for selectively connecting said first relay in series with said auxiliary winding and opening the circuit of said second relay during protection-off service and for energizing said break alarm relay independently of said contact means only when said first and second relays are connected in series.

4. In an electrical burglar alarm protection system in which a protection circuit at a protected area normally having a predetermined resistance is electrically coupled to a remote supervisory circuit at a central station during protection-on service, said supervisory circuit comprising first and second relays in series with a source of electromotive force, said first relay being responsive to decrease in current therethrough below a predetermined lower value, said second relay being responsive to increase in current therethrough above a predetermined upper value, means at the protected area for selectively connecting said supervisory circuit in series with said protection circuit to provide protection-on service and to connect said supervisory circuit to ground to provide protection-off service, an auxiliary winding having a resistance substantially equal to said predetermined resistance and coupled with the armature of said first relay, an alarm circuit governed by said supervisory circuit and including a break alarm relay, first contact means governed by said first relay for normally maintaining said break alarm relay energized, a second auxiliary winding coupled with the armature of said break alarm relay, a ground alarm relay, second contact means governed by said second relay for short-circuiting said ground alarm relay upon energization of said second relay, and means at said central station for (a) selectively connecting said first relay in series with said first auxiliary winding and opening the circuit of said second relay during protection-off service, (b) energizing said break alarm relay independently of said first contact means only when said first and second relays are connected in series, and (c) maintaining said second auxiliary

winding short-circuited during protection-on service with said first and second relays connected in series.

5. In an electrical burglar alarm protection system in which a protection circuit at a protected area normally having a predetermined resistance is electrically coupled to a remote supervisory circuit at a central station during protection-on service, said supervisory circuit comprising first and second relays in series with a source of electromotive force, said first relay being responsive to decrease in current therethrough below a predetermined lower value, said second relay being responsive to increase in current therethrough above a predetermined upper value, means at the protected area for selectively connecting said supervisory circuit in series with said protection circuit to provide protection-on service and to connect said supervisory circuit to ground to provide protection-off service, an auxiliary winding having a resistance substantially equal to said predetermined resistance and coupled with the armature of said first relay, an alarm circuit governed by said supervisory circuit and including a break alarm relay, first contact means governed by said first relay for normally maintaining said break alarm relay energized, a second auxiliary winding coupled with the armature of said break alarm relay, a ground alarm relay, second contact means governed by said second relay

for short-circuiting said ground alarm relay upon energization of said second relay, third contact means governed by said ground alarm relay and for normally maintaining the same energized, and means at said central station for (a) selectively connecting said first relay in series with said first auxiliary winding and opening the circuit of said second relay during protection-off service, (b) energizing said break alarm relay independently of said first contact means only when said first and second relays are connected in series, (c) maintaining said second auxiliary winding short-circuited during protection-on service with said first and second relays connected in series, and (d) energizing said ground alarm relay independently of said third contact means only when said first relay is connected in series with said first auxiliary winding.

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