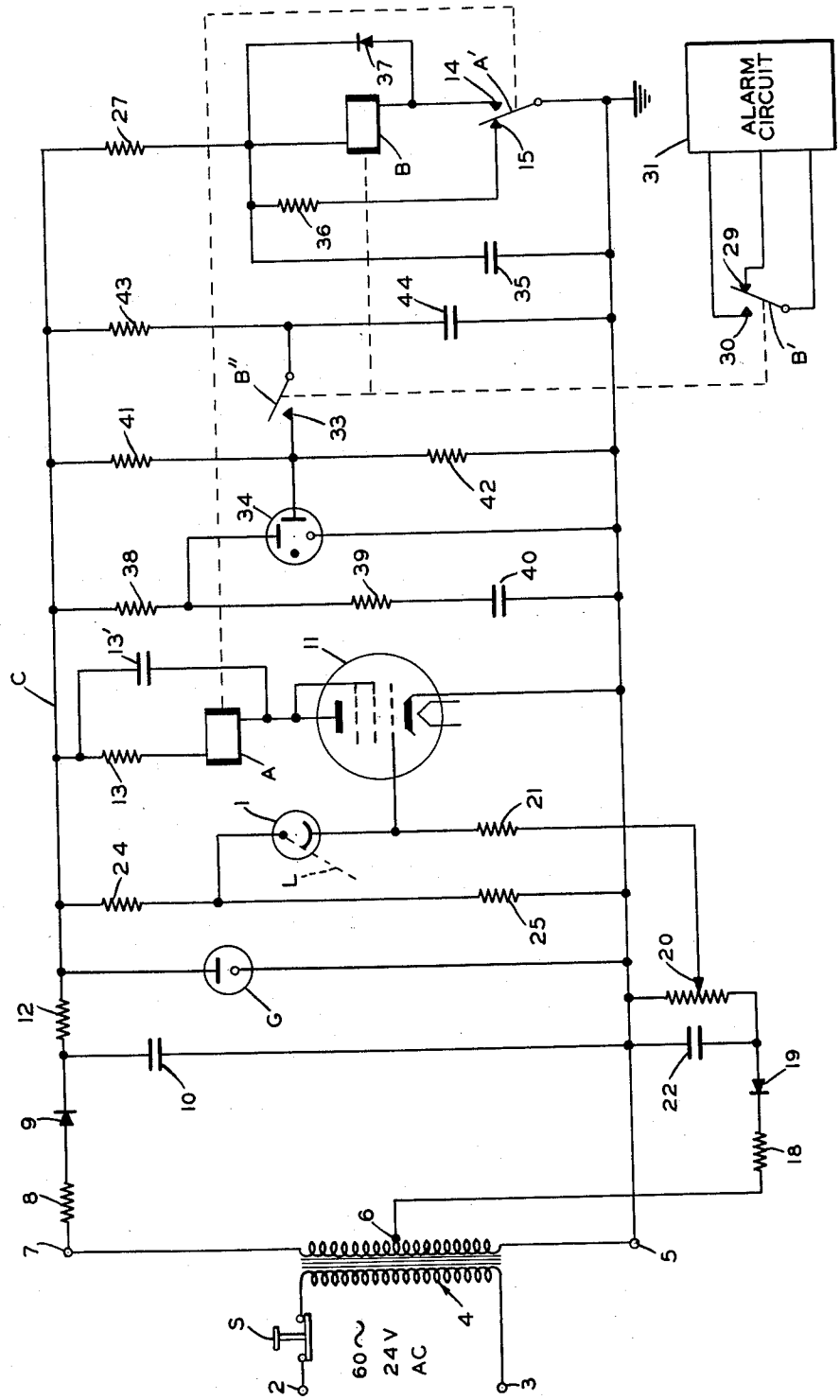
March 13, 1962 V. T. McDONOUGH 3,025,506

PHOTOELECTRIC BURGLAR ALARM SYSTEM

Filed May 6, 1958



United States Patent Office 3,025,506 Patented Mar. 13, 1962

3,025,506

PHOTOELECTRIC BURGLAR ALARM SYSTEM

Vincent T. McDonough, Verona, N.J., assignor to American District Telegraph Company, Jersey City, N.J., a corporation of New Jersey

Filed May 6, 1958, Ser. No. 733,393
3 Claims. (Cl. 340—276)

The present invention relates to burglar alarm systems, and more particularly to improvements in such systems employing a photoelectric cell responsive to a light beam and which provides an alarm indication upon interruption of the light beam.

One object of the invention has been to produce an alarm of fixed minimum duration in case of any interruption of the light beam, regardless of the duration of such interruption.

Another object of the invention has been to provide a visual indication of any such interruption, such indication being sustained until the system is reset.

A further object of the invention has been to provide for self-resetting of the system after a power failure, without actuating the continuous visual indication.

These objects have been achieved by a circuit combination utilizing the time required to charge a condenser through a resistor to provide said minimum duration alarm, while employing the sudden discharge of a condenser caused by the initiation of said alarm to actuate said sustained visual indication, both in conjunction with other circuit elements providing said automatic resetting, after interruption of power.

These and other features and objects obtainable by the practice of the present invention will be readily understood by persons skilled in the art by reference to the following detailed description taken in connection with the drawing, which is a circuit diagram illustrating one embodiment of the invention.

In the drawing, a photoelectric cell **1**, which might be, for example, of the type CEB25, is employed for surveillance of the guarded area and is normally illuminated by a light beam L from a suitable source (not shown) arranged so that the beam will be interrupted by an intruder. A suitable alternating supply voltage applied to primary terminals **2** and **3** of power transformer **4** supplies operating potentials for the system. A large alternating voltage, of 200 volts, for example, is developed between terminals **5** and **7** of the secondary winding of transformer **4**.

Terminal **7** is connected through a resistor **8** and a half wave rectifier **9** to provide a D.C. voltage to a condenser **10** which acts as a filter to smooth out the half wave pulsations produced by rectifier **9**. A vacuum tube **11**, which might be, for example, of the type 6SJ7, is provided with a suitable plate supply voltage from the secondary of transformer **4**. The circuit extends from transformer terminal **7** through resistor **8**, rectifier **9**, a resistor **12**, a conductor C, a resistor **13**, and the coil of a relay A. A capacitor **13'** shunts resistor **13** and coil A to reduce hum in the relay A. The plate supply voltage may be maintained constant at a suitable value, e.g., 150 bolts, by providing a gas regulating tube G connected between conductor C and transformer of secondary terminal **5**. Terminal **5** may be at ground potential, as shown.

When the system is in its normal operating condition, the grid bias of vacuum tube **11** is maintained at a level such that the plate current of tube **11** will be sufficient to energize relay A. Relay A is provided with an armature A' and front and back contacts **14** and **15**.

Negative grid bias for tube **11** is derived from tap **6** of the transformer secondary winding through a resistor **18**, a half wave rectifier **19**, a potentiometer **20** and a resistor

21. A capacitor **22** is provided for smoothing the half wave pulses of current. Rectifier **19** is poled oppositely from rectifier **9** so that a negative potential will be applied to the grid of tube **11**. The free end of potentiometer **20** is connected to ground. Resistor **21** also serves as the load resistor for photocell **1**. The photocell anode is supplied with operating potential by being connected to the junction of series connected resistors **24** and **25** which act as a voltage divider and are connected in parallel with gas regulating tube G. The grid of tube **11** is connected to the junction of resistor **21** and the cathode of photocell **1**.

The slider of potentiometer **20** should be adjusted so that with light beam L interrupted so that no illumination impinges upon photocell **1**, the grid of tube **11** will be maintained at a potential such that the plate current will be insufficient to energize relay A. When light beam L impinges on photocell **1**, a positive voltage is developed across resistor **21**, which makes the bias on the grid of tube **11** more positive thereby causing a larger current to flow through the coil of relay A and resulting in the energization of relay A.

When the beam of light falling upon the photocell **1** is interrupted, as by an intruder, the current passing therethrough is reduced, in turn reducing the anode current of tube **11** so that relay A is thereby de-energized. When relay A is de-energized, armature A' leaves front contact **14** thereby de-energizing a relay B theretofore held energized by its connection through a resistor **27** to conductor C, the other side of the coil of relay B having been connected to ground through armature A' and front contact **14**. When relay B is de-energized its armature B' leaves a front contact **29** and makes with a back contact **30**, thereby actuating an alarm circuit **31**, which may be of any suitable type such as, for example, a circuit of the type used to transmit alarm signals to a remote central station. Simultaneously, a second armature B'' of relay B makes with a back contact **33** and fires a three element neon lamp **34**. One of the other terminals of neon lamp **34** is connected to ground and the third terminal is connected to conductor C through a resistor **38**. Resistor **38**, a resistor **39** and a condenser **40** are connected in series between conductor C and ground. A half wave rectifier **37** is connected across relay B to suppress arcing at contact **14**.

A condenser **35** is connected between the high potential end of the coil of relay B and ground and a resistor **36** is arranged to shunt condenser **35** through back contact **15** and armature A'. Thus when relay A becomes de-energized upon interruption of light beam L, armature A' of relay A makes with back contact **15** causing condenser **35** to discharge through resistor **36**. When the light beam L is restored to photocell **1** and the normal current flow is resumed, relay A is re-energized and armature A' is transferred to front contact **14**. Relay B however cannot become re-energized until condenser **35** is charged through resistor **27**, a process requiring several seconds. As long as relay B remains de-energized, its armature B' will be made with back contact **30** and the alarm circuit **31** will be held in the alarm condition, thus achieving the minimum-duration alarm object of the invention. The length of this minimum duration may be controlled by varying the time constant of the charging circuit of condenser **35**, particularly condenser **35** and resistor **27**. When condenser **35** is substantially completely charged, relay B will become energized and armature B' will transfer from back contact **30** to front contact **29** thereby restoring the alarm circuit **31** to its normal condition.

Energization of relay B will also cause armature B'' to leave the back contact **33**. The neon lamp **34**, however, will remain illuminated until the power supply is mo-

mentarily interrupted by manually operating a push button switch S in the power line connection of the primary winding of transformer 4.

A continuous visual indication of the initiation of an alarm condition is thus provided by the three element neon lamp 34. Thel amp 34 receives an anode voltage through resistor 38 which is insufficient to fire the lamp when the circuit is normal. Resistor 39 and condenser 40 together with resistor 38 serve to hold down the anode voltage on neon lamp 34 during the momentary voltage surge which occurs when the photoelectric unit is first switched on. Resistors 41 and 42, forming a voltage divider circuit between conductor C and ground, hold the center electrode of lamp 34 at a given voltage. The center electrode of lamp 34 is connected to the junction of resistors 41 and 42 and to back contact 33. Armature B'' is connected to the junction of a resistor 43 and a condenser 44 which are connected in series between conductor C and ground. The discharge of condenser 44, whose charging is regulated by resistor 43, provides the additional firing voltage required at the center electrode of lamp 34 as armature B'' makes with back contact 33 when the light beam is interrupted. When the unit is first turned on and contact 33 is closed, the center neon electrode does not receive sufficient voltage to fire because condenser 44 cannot charge to the full 150 volts. After contact 33 opens, condenser 44 charges to 150 volts; thus the next closure of contact 33 will apply 150 volts to the center electrode which is sufficient to fire lamp 34.

Upon the occurrence of a power failure, relay A becomes de-energized and so does relay B which causes armature 32 to close back contact 33. Lamp 34 however, will not light because there is no voltage at conductor C to operate the lamp, and when power is restored, condenser 44 cannot charge fully until contact 33 opens and the lamp cannot fire until the armature B'' again closes back contact 33. In this way, illumination of the neon lamp 34 cannot occur during momentary power failures or when the power is first switched on. Illumination can occur only as the result of interruption of the light beam.

While the invention has been described in connection with specific embodiments thereof and in a specific use, various modifications thereof will occur to those skilled in the art without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. In an alarm system of the type in which there is provided a photoelectric cell and a beam of light impinging thereon and in which an alarm indication is provided upon interruption of said beam, a first relay having a coil and a set of switching contacts, a second relay having a coil in series connection with and controlled by the switching contacts of said first relay and having a set of alarm contacts and a second set of switching contacts, a discharge device having a control electrode, an anode and an anode circuit, said anode circuit including the coil of said first relay, said discharge device being arranged so that a normal potential applied to said control electrode maintains said first relay in a first condition in which said second relay is maintained in a first condition and said alarm contacts of said second relay are unoperated, means to apply said normal potential to said control electrode, said last mentioned means including and being controlled by said photoelectric cell, interruption of said light beam changing the potential applied to said control electrode to change the current flow in said anode circuit by an amount sufficient to cause said first relay to assume a second condition in which said second relay is caused to assume a second condition in which said alarm contacts and second switching contacts of said second relay are operated, means to delay by a predetermined time interval the reassumption of said first condition by said second relay upon reassumption of said first condition by said first relay, said last mentioned means including a first capacitive element connected across the coil of said second relay through said switching contacts of said first relay when said first relay is in said first condition thereof and a discharging circuit for said first capacitive element, said discharging circuit including said switching contacts of said first relay and being completed when said first relay is in said second condition thereof, an indicating device, a first source of potential connected to said indicating device, said first source being sufficient to maintain operation of said indicating device but being insufficient to initiate operation thereof, a second source of potential including a second capacitive element arranged when charged by a predetermined amount to provide a second potential sufficient, in conjunction with said first source of potential, to initiate operation of said indicating device, and means including said second switching contacts to connect said second source of potential to said indicating device thereby to initiate operation of said indicating device upon assumption of said second condition by said first relay, said last mentioned means being arranged to prevent charging of said second capacitive element by said predetermined amount after a failure of said first source of potential until said second relay assumes said first condition thereof.

2. In an alarm system of the type in which there is provided a photoelectric cell and a beam of light impinging thereon and in which an alarm indication is provided upon interruption of said beam, a first relay having a coil and a set of switching contacts, a second relay having a coil in series connection with and controlled by the switching contacts of said first relay and having a set of alarm contacts arranged when operated to transmit an alarm indication and a second set of switching contacts, a discharge device having a control electrode, an anode and an anode circuit, said anode circuit including the coil of said first relay, said discharge device being arranged so that a normal potential applied to said control electrode maintains said first relay in an energized condition in which said second relay is maintained in an energized condition and said alarm contacts of said second relay are unoperated, means to apply said normal potential to said control electrode, said last mentioned means including and being controlled by said photoelectric cell, interruption of said light beam decreasing the potential applied to said control electrode to decrease the current flow in said anode circuit by an amount sufficient to cause said first relay to assume a de-energized condition in which said second relay is caused to assume a de-energized condition in which said alarm contacts and second switching contacts of said second relay are operated, means to delay by a predetermined time interval the re-energization of said second relay upon restoration of said light beam and consequent re-energization of said first relay, said last mentioned means including a first capacitive element connected across the coil of said second relay through said switching contacts of said first relay when said first relay is in said energized condition thereof and a discharging circuit for said first capacitive element, said discharging circuit including said switching contacts of said first relay and being completed when said first relay is in said de-energized condition thereof whereby said first capacitive element is maintained discharged when said first relay is de-energized, a visual indicating device, a first source of potential connected to said indicating device, said first source being sufficient to maintain operation of said indicating device but being insufficient to initiate operation thereof, a second source of potential including a second capacitive element arranged to be charged from said first source and, when charged by a predetermined amount, to provide a second potential sufficient, in conjunction with said first source of potential, to initiate operation of said indicating device, means including said second switching contacts to connect said second source of potential to said indicating device thereby to initiate operation of said indicating

device upon de-energization of said second relay, said last mentioned means being arranged to prevent charging of said second capacitive element by said predetermined amount after a failure of said first source until said second relay has assumed said energized condition thereof, and manually operable means for terminating operation of said indicating device.

3. In an alarm system of the type in which there is provided a photoelectric cell and a beam of light impinging thereon and in which an alarm indication is provided upon interruption of said beam, a discharge device having a control electrode, an anode and an anode circuit, a first relay having a coil included in series connection in said anode circuit and having an armature and associated front and back contacts, a first source of normal operating potential for said discharge device, a biasing circuit connected to said first source and to said control electrode and including said photocell, said biasing circuit being arranged to apply a normal biasing potential to said control electrode when said beam of light impinges on said photocell and a more negative biasing potential when said beam of light is interrupted, said normal biasing potential being selected so that the anode current of said discharge device will energize said first relay and said more negative biasing potential being selected so that the anode current of said discharge device will be insufficient to maintain said first relay energized when said more negative biasing potential is applied to said control electrode, a second relay having a coil, a first armature and an associated alarm contact and a second armature and an associated back contact, means including said armature and front contact of said first relay to energize said second relay whereby said second relay becomes de-energized upon de-energization of said first relay, means to delay re-energization of said second relay for a predetermined time interval upon re-energization of said first relay, said last mentioned means including a condenser connected across the coil of said second relay and a discharging circuit for said condenser including a resistor and said armature and back contact of said first relay, an alarm circuit connected to said armature and alarm contact of said second relay for giving an alarm indication upon de-energization of said second relay, a three element neon lamp, circuit means for connecting said neon lamp to said first source of operating potential, said first source providing a potential sufficient to maintain illumination of said neon lamp but insufficient to initiate illumination thereof, a second source of a voltage surge, said second source including a capacitive element coupled for charging to said first source and, when charged by a predetermined amount, providing a second potential sufficient in conjunction with said potential from said first source, to illuminate said neon lamp, means including said second armature and associated back contact of said second relay for connecting said capacitive element to said neon lamp upon de-energization of said second relay thereby to cause said lamp to become illuminated, said last mentioned means being arranged to prevent charging of said second capacitive element by said predetermined amount after failure of said first source until re-energization of said second relay, and manually operable means for extinguishing said lamp.

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