June 7, 1949. K. L. BERNINGER ET AL 2,472,741

LIGHT CONTROL

Filed April 16, 1947

Fig. 1

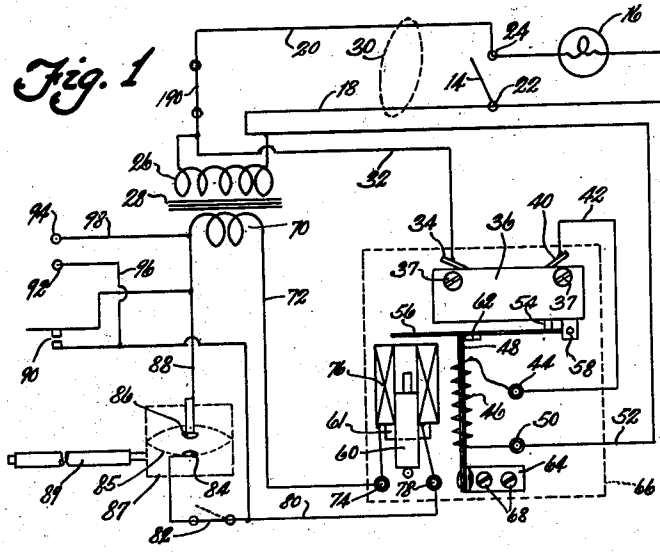


Fig. 3

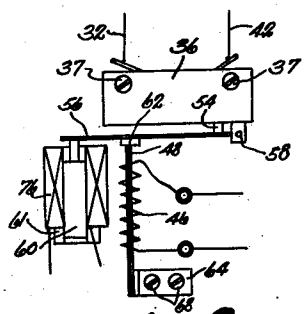


Fig. 2

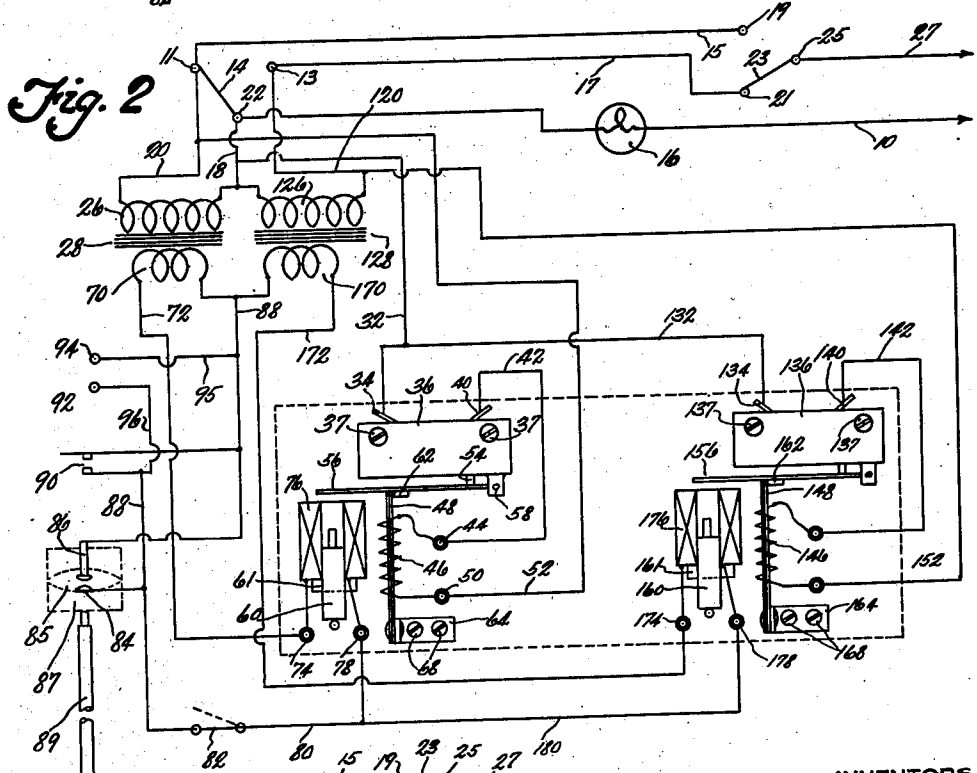
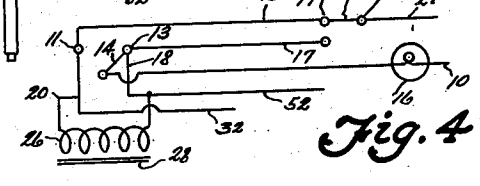


Fig. 4



INVENTORS

KENNETH L. BERNINGER

CHAUNCEY H. LOWREY

Russell C. Lane

ATTORNEYS

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LIGHT CONTROL

Kenneth L. Berninger and Chauncey H. Lowrey, Dayton, Ohio, assignors to The Eldee Products Company, Dayton, Ohio, a corporation of Ohio

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12 Claims. (Cl. 315—361)

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This invention relates to the control of electric circuits where the manifestation of the work circuit is desired to continue for a predetermined period of time after a control circuit is selectively energized.

One object of the invention is to so control an electric circuit that a predetermined elapse of time ensues before any apparent change in the circuit takes place.

More specifically, an object of the invention is to control a light circuit such that it is instantaneously energized in response to a premeditated act of an attendant and thereafter automatically deenergizes after the elapse of a predetermined period.

Another object of the invention is to control a flood-light posted at the entrance of a residence garage or the like so that a single operation of the controlling switch will energize the light circuit which will continue over a sufficient period of time to permit a person to leave the car, open the garage doors, drive the car in the garage, condition the car for the night, and retreat to the living quarters, before the light circuit is automatically deenergized.

Still another object of the invention is to provide an electric switching unit that will hold a circuit closed for a selected period of time after and following an initial current passage.

Yet another object of the invention is to provide an automatic switching unit for automatically deenergizing either circuit branch of a two point remotely controlled light circuit upon the elapse of a predetermined period of time after the respective branch is energized from either one of the two points of remote control.

Another object of the invention is to provide a circuit controlling unit of the suspended or delayed action type that may be plugged into an existing light installation without forfeiting any of the features of the original installation of said light.

Another object of the invention is to provide a delayed action circuit controller of the unit type that is connectible into an electric circuit fitted with manual switches without disrupting or disorganizing the control of the circuit by said switch, and in which said controller provides for instantaneous closing of the circuit with timed opening of said circuit after a single manipulation by an actuator of said unit, the unit also having means embodied therein for by-passing its operation from a remote or other point.

The foregoing objects and advantages are accomplished by providing a unitary construction

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that is tapped into an existing electric circuit to be controlled, and which gains its energy from the taps so made. A transformer whose primary is in the circuit to be controlled develops energy in the secondary to which is connected a primary actuator switch in circuit with a coil winding in attractive relation to an armature whose movement controls a snap-action switch across the lines to the device to be controlled, held in circuit closed position for a predetermined period of time by a restraining device energized by the flow of current to the device in the circuit to be controlled. More specifically, to a work circuit, such as a flood-light connected to a current source through a manual switch for controlling the flood light, there is connected a controller unit embodying a control circuit and an impulse circuit. The control circuit is shunted across the primary of a step-down transformer connected to the work circuit at the terminals of the original control switch, and the shunt includes a heater element in series with a normally open snap switch actuated by an armature of an electric relay in the impulse circuit. The impulse circuit includes the secondary of the step-down transformer, the winding of the electric relay, an off-on switch and a pneumatic switch actuated by a drive-way actuator. The impulse circuit on being closed, even momentarily, energizes the winding of the relay that actuates an armature or lever to close the snap switch which closes the work circuit, and a bi-metal detent exposed to a heating coil springs into place to hold the snap switch in circuit closing position, while the flow of current in the heating coil effects retraction of the bi-metal detent to permit opening of the work circuit after a measured interval of time.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1, is a circuit diagram of the control unit applied to a work circuit having a single point of control.

Fig. 2 is a circuit diagram of a control unit suitable for a work circuit normally controlled from two remote points.

Figs. 3 is a fragmentary view showing parts in a moved position.

Fig. 4 is a fragmentary view of a modification, by which a single transformer is substituted for the double transformer shown in Fig. 2.

While the improved system is adapted to the

control of various kinds of work circuits under widely varying conditions, it is especially adapted for and will be described herein as applied to the control of a flood-light for residence garage lighting. It is to be understood, however, that it is not intended to limit the invention to such disclosure nor to the particular construction of the unit, but it is aimed to cover all modifications, alternative constructions and uses falling within the spirit and scope of the invention as expressed in the appended claims.

With particular reference to the drawings, 10 and 12 indicate the line conductors of a power supply or current source attached to a wall switch 14 for the control of a flood or yard light 16 as in the usual installation. Such installations are usually found on the larger estates or residences, and serve to light the approach to a garage when turned on. They are customarily needed but for a short duration of time, five minutes for example, or long enough for the driver of a vehicle to get out from the same, open the garage doors, get in the car and drive it into the garage, close the garage doors and leave the garage. Nearly half of the time, the lighted lamp will be forgotten, particularly if it is an installation of the two-way or remote control type. The herein described control unit will take care of the matter and automatically turn the light on as the vehicle approaches the garage, and turn off the light after a measured interval of time, if it is forgotten.

The control unit is provided with a cable containing the necessary conductors 18 and 20 for attaching to the terminals 22 and 24 of the original light switch 14, so that a primary winding 26 of a step-down transformer 28 is in series with the lamp 16. The cable is generally indicated by the dashed circle 30 and may be of any convenient length to extend from the wall switch 14 to a position selected for the installation of the control unit which may be attached to the wall near the wall switch, or at a point near the garage door opening.

In any event, the control unit embodies a control circuit for the work circuit, to include a lead 32 joined to the conductor 20 and the terminal 34 of a normally open snap switch 36 whose other terminal 40 is connected to a lead 42 that connects to a terminal post 44 of a heater element composed of a heater coil 46 trained about a bi-metal blade 48 and thence connected to a binding post 50 from which extends a lead 52 joining the conductor 18 of the cable 30. Thus, the control circuit is shunted across the primary of the transformer and is continuously in communication with the power supply lines 10 and 12 except for the normally open switch 36.

Pivoted near the snap switch 36, so as to be in engaging relation with an actuating pin 54 thereof, there is a leaf member 56 that is free to turn about a pivot pin 58, the free end of which leaf is disposed over the end of a core 60 of an electromagnet, and intermediate of which leaf there is a riser 62. The riser is of such dimension and is so positioned with respect to the bi-metal blade 48 that the free end of the blade 48 may engage either the body of the leaf 56 or may flex to that position in which the riser is interposed between the leaf 56 and the free end of the blade 48 as shown in Fig. 3. The blade 48, responding to a predetermined change in temperature effected by the heating coil 46 may take up either position. Toward that end, the blade is attached at one end to a bracket 64 which is fixed to a common base 66 by screws 68, which base supports all of the other elements of the control unit.

The impulse circuit includes a secondary winding 70 of the transformer 28 to which is connected a lead 72 joining a terminal post 74 of a relay winding 76 in turn connected to a terminal post 78 after encompassing the core 60. To the terminal post 78 is connected a lead 80 joining a master control switch 82 connected to a contact 84 of a pneumatic switch having a cooperating contact 86 connected by lead 88 to the other end of the secondary 70, of the transformer 28. The contact points 84 and 86 constitute the elements of an impulse switch involving a diaphragm 85 over a chamber 87 that is subject to the change of air pressure within a hose element 89 that may be laid over the path of vehicle movement so that treading or depression of the hose will actuate the diaphragm 85 to close the contacts 84 and 86.

Such action, that is treading on the hose closes the electrical path through the secondary 70 of the transformer, which now becomes energized and current thereupon flows through the relay winding 76 if the master switch 82 is closed. The unit, to provide for full adaptability under all conditions, is also provided with a normally open manual impulse switch 90 shunted across the switch 85, to connect with the leads 80 and 88, as is also a pair of binding posts 92 and 94 having leads 96 and 98 connected with the leads 80 and 88 respectively. By those means, the control unit can be set into operation at the control unit by closing the manual switch 90, or by closing of a pendant or like switch attached to proper leads and connected from a remote point to the terminal posts 92 and 94.

In any event, closing of either of the switches at 84, 86 or at 90, or at 92, 94, the result is the same. Even a momentary closing of the impulse circuit at any one of these points energizes the winding 76 that actuates the leaf 56. That is because the transformer 28 is one of the step-down type in which no substantial current flows in the primary 26 until a circuit is closed through the secondary 70. When the winding 76 is energized the core 60 is drawn up with such force as to strike the leak 56 and push it upward enough that the actuating pin 54 of the switch effects closing of the switch 36, and allows the bi-metal member 48 to flex to the position shown in Fig. 3 where the end of the member engages the under side of the riser 62 to hold the switch closed until the member 48 reflexes under the rise of temperature effected by closing of the control circuit to disengage the riser. When the leaf member 56 is moved to depress the actuating pin 54, a circuit is closed through the snap switch 36 in the control circuit which by-passes the primary 26 of the transformer and energizes the lamp 16 or other work circuit connected therewith. The heater winding 46 is also energized by closing of the snap switch 36. A transformer of the bell-ringing type is preferred, or one similar thereto in which the primary is so constituted that though continuously connected to the source its primary 26 in series with the work element offers too much resistance to permit full manifestation of the work device. Consequently the light 16 or other work device is not energized, because of the high impedance in the primary 26, until the same is by-passed or shunted by a lesser resistance path, here constituting the control circuit. The resistance thru the contact circuit including the heater coil 46, is relatively low as

compared with that through the primary of the transformer, and offers no substantial obstruction to the full manifestation of the lamp 16 or other work device.

At the instance of closing the impulse circuit and actuation of the leaf 56 the heating coil 46 is cold and immediately flexes to a position with its free end beneath the riser 62 carried by the leaf 56. With the opening of the impulse circuit at any point the leaf may now drop back so that the riser 62 engages the end of the bi-metal member 48 which holds the actuating pin 54 far enough depressed to maintain the snap switch 36 closed. So long as the snap switch is closed the source current flows through the heater coil 46 which after a measured length of time causes the bi-metal member to reflex to a position to one side of the riser 62 which now fully retracts to its rest position and thereby opens the control circuit. Opening of the control circuit reinserts the primary 26 into the work circuit so that the light 16 or similar work device becomes insufficiently energized to function. Thus, with only a momentary closing of the impulse circuit the work device is energized which continues to operate for a predetermined period of time and then automatically becomes deenergized. As a practical example, the heating coil and bi-metal element are so chosen, mounted and adjusted, that the control circuit is opened about five minutes after the closing of the impulse circuit. Either a longer or a shorter period of time may be selected and provided for to suit other selected conditions of operation.

In the scheme of Fig. 1, the snap action switch 36 is mounted on the base 66 by the screw devices 37 while the coil winding 76 encircles the core 60 having a bracket 61 mounted on the base 66 which constitutes an electromagnet set in attractive relation to the movable armature or core 60 for actuating the leaf 56. Thus, when the coil 76 is energized, the core is attracted and the snap switch closed.

In Fig. 1, there is shown a system for the automatic control of a work circuit that is normally controlled by a single manual switch, such as the usual wall switch 14. All of the elements of the control unit are mounted on a single base board 66 and terminate at one point in a cable 30 having the leads 18 and 20 ready for attachment to the terminals 22 and 24 of the wall switch, and terminating at another point in a flexible hose 89 that may be laid out on the drive-way in the path of the vehicle to be driven into the garage. In Fig. 2, a similar adaptation is made for the type of work circuit normally controlled from either one of two remotely separated points. There the line conductor 10 of the work circuit connects with the work device or lamp 16 and thence to the switch point 22 to which is connected the switch 14 that is here selectively engageable with the switch points 11 and 13 from which extend the branches 15 and 17 respectively joining posts 19 and 21 respectively selectively engageable by a switch member 23 pivoted at 25 to which is connected the other line conductor 27 connected with the current source. The usual practice is in the case of a garage light to mount one of the switches 14 and 23 in the garage and the other at the entrance door of the residence, so that by manipulating the switch in nearest proximity, the lamp 16 may be either lighted or extinguished.

The control unit for the two point control work circuit embodies the same principles but duplicates and interconnects some of the elements so as to effect complete control of the work circuit regardless of the position of the switches 14 and 23 with the light 16 non-energized. The same reference numerals are used so far as possible to indicate similar or like parts, and where there is duplication, the duplicated parts are indicated by the same reference character increased by 100. Thus two step-down transformers 28 and 128 have their primaries 26 and 126 continuously connected into the work circuit source lines by leads 18, 20 and 120 formed in the cable 130 and joined to the switch terminals 22, 11 and 13 respectively. To accomplish this, one end of both primaries is jointed to the lead 18 which becomes a common lead for both, and the lead 88 joins one end of both secondaries 70 and 170, the secondary 70 being connected into the impulse circuit substantially as has been described, while the secondary 170 is connected into the impulse circuit in a similar manner by extension of certain connections as will be described. A lead 172 connects the other end of secondary 170 to post 174 and thence through coil 176 to post 178 from which lead 180 runs to join the lead 80 connecting the master switch 82 and contact 84 of the impulse switch. Disposed adjacent the coil 176 is the leaf 156 for actuating the snap switch 136 to close the control circuit including the lead 132 extending from 32 and the lead 142 connecting with the heating coil 146 and thence by lead 152 back to the line 120 and to the post 13. The leaf 156 carries the riser 162 so positioned that it is disposed over the end of the bi-metal member 148 when the leaf is first actuated by the coil 176 in a manner similar to the action of the leaf 56 and bi-metal member 48.

In Fig. 2, the work circuit may be manually controlled by either original switch. It may be turned on at either switch 14 or 23 and left on as long as desired, or the circuit may be opened at the same point or at the other point. When the manual control switches of the original installation are both off, the work circuit may be closed and automatically opened by use of the control device, from either of three points, that is, the pneumatically operated switch 85, or the manual contacts 90, or yet the remote control switch connected at 92 and 94. The position of the switches 14 and 23, if the master switch 82 is closed, will determine which of the relay devices will become effective. When either of the relay devices become effective, the work circuit will be immediately energized and after the elapse of a measured period of time will be deenergized automatically by the control unit. With the lamp 16 off and the switches 14 and 23 both in the open position as shown in Fig. 2, and in engagement with the posts 11, 21 respectively the primary 126 of the transformer 128 is connected in series with the work device 16 and the relay device 176, 136 becomes effective. With a momentary closing of either of the switches 85, 90, or the remote control switch attached to posts 92, 94 the magnet winding 176 will be energized, and the switch 136 closed to energize the work device 16 and the heater coil 146 as has been described with respect to Fig. 1. When the impulse circuit is closed, current flows from the secondary 170 through lead 172 to and through coil 176 and back through 180, and 80, switch 82 and impulse switch and lead 88 returning to secondary 170. That circuit being closed, the leaf 156

is actuated to close snap switch 136 which in turn energizes the control circuit that extends from the conductor 18 through 32 and 132 to the switch 136 and thence by lead 142 to the heater winding 146 and returning through leads 152, and 120 to post 13. Thus, the work circuit is energized and the lamp 16 is lighted, with current flowing through the heater coil to actuate the bi-metal blade 148 which after a measured interval of time allows the snap switch to open.

In Fig. 4 there is shown an adaptation by which a single transformer 28 serves to supply power for either branch of the double control point circuit shown in Fig. 2. It differs from the other circuits principally in that the winding 26 of the transformer has the opposite ends not only connected to the lines 32 and 52 as in Fig. 1, but also has those ends connected to the switch terminals 11 and 13 as in Fig. 2, while the work device 16 is connected to the switch point 22 as in Fig. 2. With the switches 14 and 23 in the off positions shown, there is no glow of the lamp due to the characteristics of the circuit as has been explained. However, upon closing of an impulse switch, the control circuit is completed so that current in the line 27 follows through 25, 23, 19, 15, 11, 20, 32, to the snap switch 36, which being closed completes a circuit back to the lamp 16 by way of leads 52, 18, 13, 14, 22, and 10. By that means a single transformer serves the purpose of control for the lamp 16 in either off positions of the switches 14 and 23.

From the foregoing it should be seen that the work circuit may be controlled by the control switch of original installation without hindrance from the automatic control unit that has been attached thereto. That means that the original installation has not been deprived of any of its features by the installation of the additional control unit. On the contrary, the control has been greatly augmented because with it the light can be turned on at any one of several points by momentary closing of one of the impulse switches, and the unit will see to it that the light is turned off again after a measured interval of time. As a further example, the person may momentarily close the switch 90 and then open the garage doors, get in the car, start the engine, drive the car out of the garage, get out of the car and close the garage door, return to the car and drive away. The control unit will in due time, whatever the unit is set for, turn off light. The hose of unit having been laid across the path of vehicle on its return, the control unit is all set for reoperation on return of the vehicle which upon rolling over the hose gives such momentary closing of the impulse circuit that the light is turned on long enough for the vehicle to be replaced in the garage and readied for the night. As a safeguard against unintentional use of the light, such as during the daytime or while absent for an extended time, the master switch 32 is opened which interrupts all operation of the unit, but does not interfere with the manual switches of the original installation. If preferred, a switch 190 may be connected into one of the leads 18 or 20 of Fig. 1, which will disorganize the whole unit when open, so that there is then no current impression on the transformer. A similar switch if placed in the lead 18 to the mid point of the two primaries 26 and 126 of Fig. 2 would serve a like purpose.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In a control unit for controlling a lamp circuit embodying an electric lamp and a manually controlled switch connected to a current source, the combination comprising, a transformer having a primary winding across the manual switch, a secondary winding, a control circuit including a control switch and a heating coil shunting the primary winding, an electromagnetic winding and an impulse switch serially connected with the transformer secondary, a pivoted leaf responding to the energization of said electromagnetic winding for actuating the control switch, a bimetal latch exposed to the heating coil and operable to hold the pivoted leaf in control switch closed position, and means for actuating the impulse switch for energizing the magnet and the lamp circuit although the manually operated switch is open.

2. The combination set forth in claim 1 wherein the primary of the transformer is constantly connected in series with the lamp circuit to be controlled and offers such substantial reluctance that the lamp is nonoperative, and wherein closing of the impulse switch effects shunting of the transformer primary by energizing the control circuit and substantially full energizing of the lamp circuit.

3. The combination set forth in claim 1 wherein the transformer is of the step-down type and has a primary winding serially connected with the source and the lamp circuit, and whose secondary winding must be in circuit completed condition before energy will flow in the control circuit to by-pass the primary winding and energize the lamp circuit.

4. In a conventional lighting circuit embodying an electric lamp and a pair of control switches permanently connected to a current source for energizing the lamp from either of two more or less remote points, a control unit adapted to be connected to one of the switches for predetermined control of the lamp circuit while the control switches are both open and comprising in combination, a pair of current transformers having primary windings connected in series, means connecting the primaries with one of the control switches so that one or the other primary will always be connected in series with the electric lamp when both of the control switches are open, a secondary winding for each transformer, a solenoid connected with each secondary, a common return for both solenoids and an impulse switch connecting the common return to both of the secondaries, a pair of control circuits connected to the lighting circuit in parallel with the primaries, each control circuit including a normally open snap action switch associated with each a solenoid, and time restoring latch means for holding the control switch closed for a predetermined period of time, said impulse switch when closed completing a circuit through the secondary and solenoid whose primary is then in series with the electric lamp, whereby, the associated snap switch closes the respective control circuit to shunt the serially connected primary and give full energization to the electric lamp of the lighting circuit.

5. In a conventional lamp circuit embodying an electric lamp device and control switch permanently connected to a current source, a control

unit adapted to be connected to the control switch for predetermined control of the lamp circuit, and comprising in combination, a transformer having a primary constantly impressed with the potential of the source, a snap control switch and a heating device in series connected across the transformer primary and adapted to energize the lamp device when the snap switch is closed, an actuating member for closing the snap switch, an electromagnetic device for moving the actuating member, a time controlled means including said heating device for retaining the snap switch closed for a predetermined period of time and means including the secondary of said transformer for energizing said electromagnetic device to selectively close the snap switch whereby a single manual manipulation of the control unit energizes the lamp device and automatically deenergizes the same after a selected time interval.

6. The combination set forth in claim 5 wherein the means for energizing the electromagnetic device include a plurality of impulse switches for connecting the transformer secondary with said device and wherein one of said impulse switches is a pneumatic pouch and air column adapted to be distorted for deflecting the pouch.

7. In a conventional lamp circuit embodying an electric lamp device and control switch permanently connected to a current source, a control unit adapted to be connected to the control switch for predetermined control of the lamp circuit, and comprising in combination, a current transformer having a primary winding connected across the control switch to be serially connected with the lamp device when the control switch is open, a control circuit including a normally open snap action switch and heating coil serially connected and joining the lamp circuit in parallel with the transformer primary, an actuating leaf for the snap action switch, a bimetal latch associated with the heating coil and actuating leaf for controlling the length of time the snap action switch remains closed, and manually operated means energized by the transformer secondary for moving the actuating leaf to close the snap action switch.

8. In a conventional lamp circuit embodying two remote controlling switches for energizing and deenergizing the lamp circuit manually, the combination of means for energizing the lamp circuit upon the occurrence of a predetermined event though the two remote controlling switches remain open, and means for automatically opening the lamp circuit at a measured interval of time after the lamp circuit is energized, means for taking energy from the lamp circuit including a current transformer having a primary winding connected to one of the remote controlling switches so as to be in circuit completing connection with the lamp circuit whenever both of the remote controlling switches are open, a control circuit shunting the transformer primary and including a snap action switch and heater element in series so as to be energized by the lamp circuit and by-pass the primary whenever the snap action switch is closed, lever means for closing the snap action switch, a bimetal latch for holding the lever in switch closed position, said latch being automatically responsive to the heater element for releasing the lever to the switch open position, and means actuated by current from the transformer secondary for selectively actuating the lever means, whereby the occurrence of a predetermined event effects the energization of the lamp circuit though both remote control switches are both open.

9. The combination set forth in claim 8 wherein the means for energizing the lamp circuit operates equally effectively whether the two remote controlling switches are in one off position or in the other off position.

10. In the conventional lamp circuit embodying two remote controlling switches for energizing and deenergizing the lamp circuit manually, the combination of means for energizing the lamp circuit upon the occurrence of a predetermined event though the two remote controlling switches remain open, and means for automatically opening the lamp circuit at a measured interval of time after the lamp circuit is energized, said means for energizing and automatically opening the lamp circuit comprising a compact unit electrically connected across one of the two remote controlling switches, and includes transformer means having a primary winding impressed with the current of the lamp circuit and adapted to develop energy in a secondary winding, means connecting the automatic circuit opening means with the primary winding means of the transformer, and impulse actuating switches for effecting actuation of the automatic means.

11. In the conventional lamp circuit embodying two remote controlling switches for energizing and deenergizing the lamp circuit manually, the combinat on of means for energizing the lamp circuit upon the occurrence of a predetermined event though the two remote controlling switches remain open, and means for automatically opening the lamp circuit at a measured interval of time after the lamp circuit is energized, said means for energizing the lamp circuit comprising a unit attached to one of the remote controlling switches and including transformer means permanently connected into the lamp circuit for providing a source of energy for the unit, switch means connected in parallel with the primary of the transformer means for controlling the lamp circuit, and an impulse switch and electromagnet means for controlling the operation of the parallel switch means controlling the lamp circuit, said switch means in parallel operating in either position of the remote controlling switches to open the lamp circuit after a predetermined elapse of time from operating the impulse switch.

12. In the conventional lamp circuit embodying two remote controlling switches for energizing and deenergizing the lamp circuit manually, the combination of means for energizing the lamp circuit upon the occurrence of a predetermined event though the two remote controlling switches remain open, and means for automatically opening the lamp circuit at a measured interval of time after the lamp circuit is energized, said means for automatic opening the lamp circuit being connected across the manual switches and includes a pair of transformers each having a primary winding insertible alternatively in the lamp circuit when the two remote controlling switches are both in the open circuit position and adapted to power the control unit, a pair of control circuits in parallel respectively with the primaries of said transformers and including each a snap switch of open contact type and a heating coil in series therewith, electromagnetic means in association with each snap switch and heating coil for controlling the operation of respective snap switch, and impulse switch means for momentarily closing a circuit through the electro-

magnetic means associated with the primary winding energized by the lamp circuit, the snap switch and heater coil therewith associated operating to open the lamp circuit after a measured interval of time after the momentary closing of the impulse switch.

KENNETH L. BERNINGER.
CHAUNCEY H. LOWREY.

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