

March 15, 1966

L. J. WOODWARD

3,240,960

PHOTOELECTRIC LIGHTING CONTROL

Filed Oct. 5, 1962

3 Sheets-Sheet 1

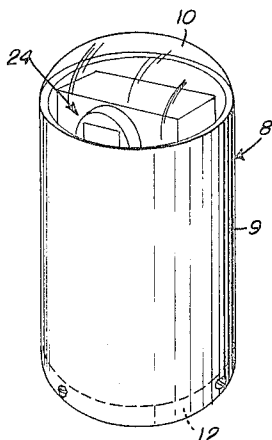


FIG. 1

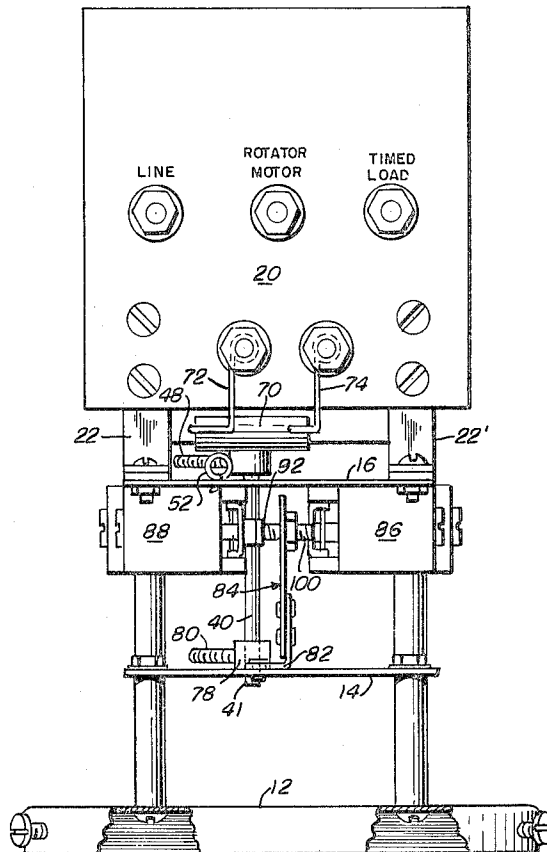


FIG. 2

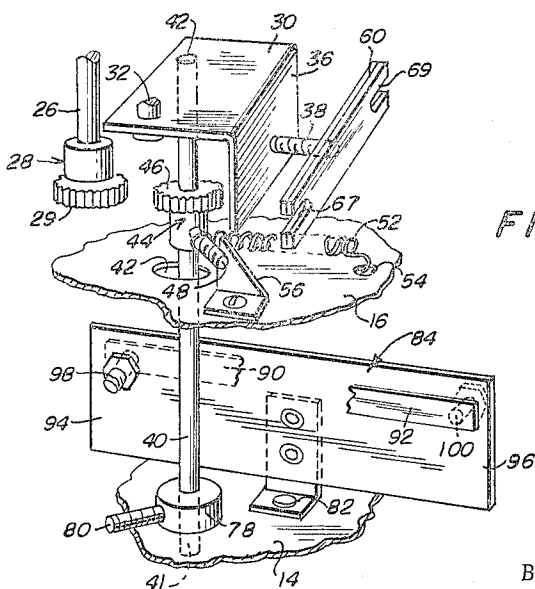


FIG. 5

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3 Sheets-Sheet 2

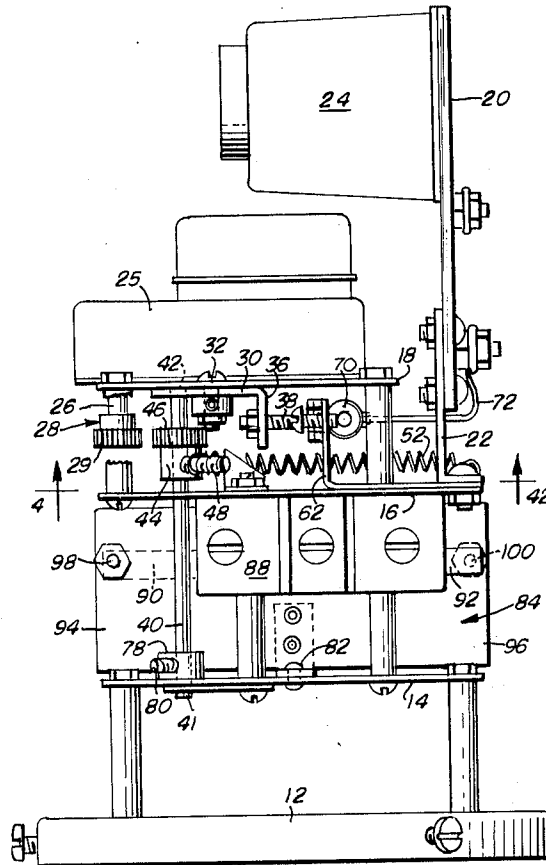


FIG. 3

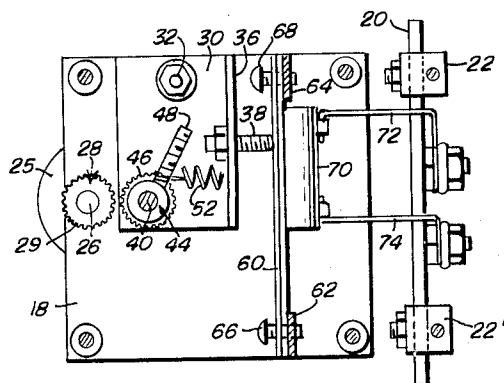


FIG. 4

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3 Sheets-Sheet 3

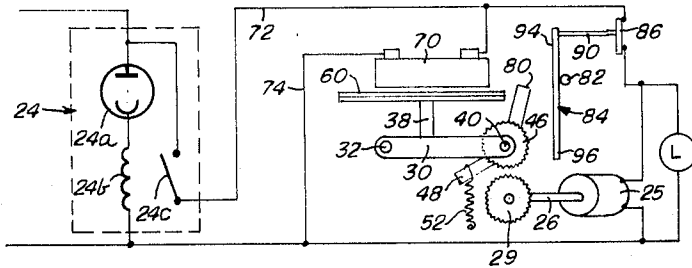


FIG. 6

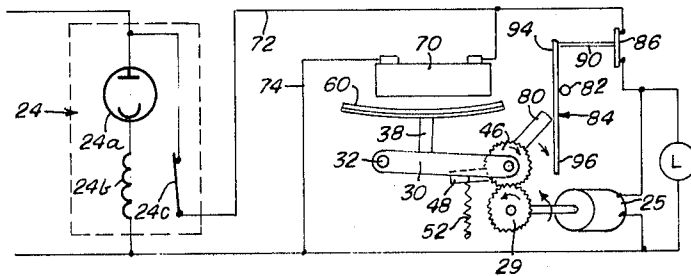


FIG. 7

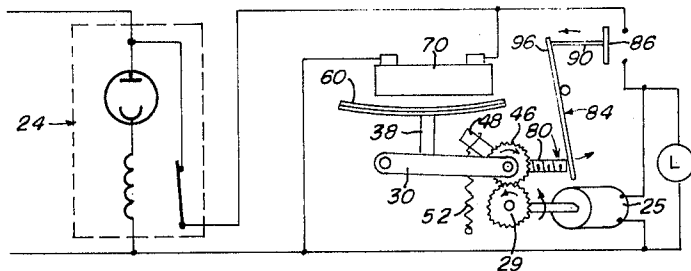


FIG. 8

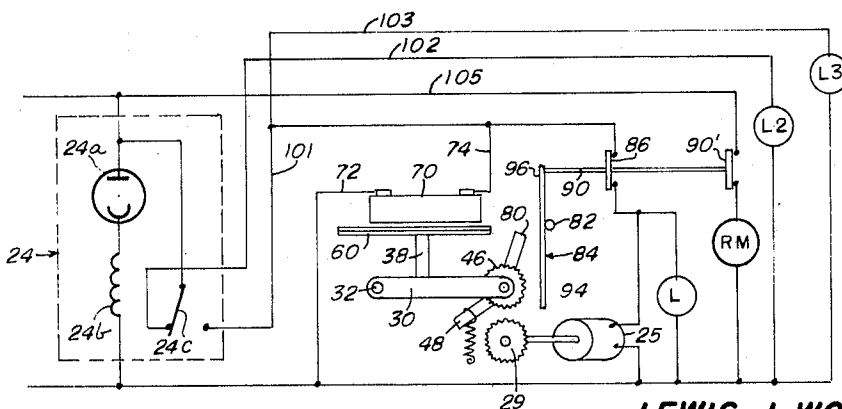


FIG. 9

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PHOTOELECTRIC LIGHTING CONTROL
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Filed Oct. 5, 1962, Ser. No. 228,637
8 Claims. (Cl. 307—117)

This invention relates to a photo-electric device for controlling an electrical source to an advertising device, and in particular relates to an instrument for turning an electric powered sign on at dusk, and turning it off at a selected number of hours after dusk.

It is known to the prior art to control various illuminated signs, and other advertising media, through the combination of a photo-electric device and a timing mechanism. In general, however, the prior art devices require resetting several times a year due to daylight-saving time, seasonal time changes and power failures of one sort or another. Since resetting must be done by one skilled in the control art, and requires to and from travel to signs which are sometimes located at remote distances from a service installation, it is a primary objective of this invention to provide a photo-electric control which automatically resets itself regardless of time changes, power outages, and the degree of daylight available due to seasonal changes.

Another objective of this invention is to provide a control of the character described in which the power source is always under the control of the photo-electric unit.

A still further objective of the invention is to provide a rugged, inexpensive, and simple structure which is capable of easy orientation with respect to adjacent signs, street lights, and the like, and in which transient illumination—such as lightning and automobile head lamps—will not be effective in turning the sign off.

Another important objective of the invention is to provide an electric sign control which is conveniently adjusted such that it will turn a sign (load) off from three to nine hours after the sign is turned on.

The present invention recognizes and takes advantage of the habits of the populace as their living habits vary from summer to winter conditions. During the summer months, people, particularly vacationers and other travelers, are known to stay out later than in the winter. Driving activities in particular are more curtailed during the winter months. The control function of this invention takes advantage of these activity habits rather than some set hour of a clock. For example, assume that a sign as controlled by the present invention is preset to burn for six hours. In the middle of the winter the sign will turn on at approximately 5:30 p.m., and turn off at approximately 11:30 p.m. In summer, however, the sign will turn on at approximately 8:30 p.m., and turn off at approximately 2:30 a.m. the next morning. It can thus be seen that this "fixed time burning" concept permits a more effective utilization of the advertising value of the sign without the previously mentioned costly service charges.

The invention disclosed herein accomplishes the desired functions by always maintaining the control under the command of a photo-electric device and through the provision of means to cause a reset operation at each dawn. In general, the device provides a control wherein the power source is connected to the sign at dusk by a photo-electric element, a timing unit which disconnects the power at a pre-selected number of hours thereafter, and photo cell means to reset the timer at the next dawn.

It is still a further object of the invention to provide a device for controlling the operation of a sign which is applied directly across the power source without the requirement of a specific "control circuit."

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Another important objective of this invention is to provide circuitry of the type described wherein a rotator control for a rotator motor is included in a manner causing a revolving sign or the like to rotate during daylight hours and during the hours the sign is burning but not during other periods.

An additional objective of this invention is to provide a control which adapts to a variety of mounting arrangements such as direct conduit support, strap mountings around the outer enclosure which makes it suitable for mounting on or in a sign, the side of a building, the top of a pole, the back of an outdoor advertising panel, and like environments.

A still further objective of this invention is to provide a control, the proper functioning of which is independent of gravity forces. The invention does not depend on mercury switches or weight and is, therefore, not positioned sensitive. It will function equally well in a side-wise or up-side-down position. Stated differently, all movable elements are positively driven.

Another important objective of this invention is to provide a control in which "all night" dusk to dawn and "all day" dawn to dusk loads can be controlled in accordance with natural daylight conditions.

Still another objective of this invention is to provide a control which can turn "on" an electric load at the same time a different load is turned "off" at a selected time.

These and other important objectives and advantages of the invention will hereinafter become more apparent from the following description of the drawings, illustrating a presently preferred embodiment thereof, and wherein:

FIGURE 1 is a perspective view of the invention;

FIGURE 2 is a rear elevational made of the device with its outer cover removed;

FIGURE 3 is a side elevation thereof;

FIGURE 4 is a sectional view along the line 4—4 of FIG. 3.

FIGURE 5 is a diagrammatic perspective of several of the moving parts of the device;

FIGURES 6, 7, and 8 are partially schematic, partially diagrammatic views showing operational features of the circuitry; and

FIGURE 9 is a schematic disclosing the circuitry with a rotator control, and "all day" and "all night" controls for auxiliary loads.

Referring now more particularly to the drawings, wherein like elements are indicated by like numerals, the structure of this invention is generally designated by the numeral 8. A casing 9, having a transparent dome 10, provides a housing which is bottomed by a base member 12. Framing for the control is comprised generally of the base 12, a lower space plate 14, a middle spacer plate 16, and an upper spacer plate 18. A terminal board 20 of insulating material is secured to the middle plate 16 by a pair of upwardly extending L-shaped brackets 22 and 22'. A photo-electric cell 24 is fastened to the upper portion of the terminal board.

Mounted above plate 18 is a conventional slow speed synchronous timer motor 25 which has an output shaft 26 depending downwardly therefrom. The output shaft extends through an aperture in plate 18 and, at its lower end, is terminated by a collar 28 which is geared at 29. Immediately beneath the plate 18 is a rectangular rocker bracket 30 which is pivotally secured to plate 18 about a stud shaft 32. A downwardly depending leg 36 of bracket 30 threadably carries a horizontal adjustable abutment screw 38 therethrough. The purpose and function of screw 38 will become apparent hereinafter.

A shaft 40 has a lower end 41 rotatably and rockably received in lower plate 14 and an upper end rotatably received by an aperture 42 in one corner of bracket 30.

The mid-portion of shaft 40 extends through an enlarged opening 42 in framing plate 16. Intermediate its length, and spaced within the plates 16 and 18, the shaft 40 carries a collar 44. The collar has an outwardly extending upper flange 46 which is geared to mesh with the downwardly depending timing gear 29. The shaft 26, of course, transmits a one-way rotary turning movement in accordance with the output of the timing gearing of motor 25.

A threaded abutment screw 48 extends radially outwardly from the collar 44. The gear 46 is normally maintained out of engagement with the motor gear 29 by way of a spring 52 extending between the abutment screw 48 and a securing point 54 of plate 16. The abutment screw 48 is thus biased by spring 52 against a stop lug 56 extending upwardly from the plate 16.

A bi-metal member 60 is secured between plates 16 and 18 by a pair of L-shaped brackets 62 and 64 by means of screws 66 and 68. The ends of the bi-metal are recessed at 67 and 69 in an amount slightly larger than the diameters of screws 66 and 68. This coupled with the fact that the screw heads of 66 and 68 are maintained in a generous spaced relationship with brackets 62 and 64 permits easy bowing of the bi-metal. The bi-metal member 60 is positioned approximately normal to the adjustment screw 38 of depending leg 36. The spring 52 normally maintains the screw 38 in engagement with the bi-metal. Also supported between plates 16 and 18 is a heating element 70 which is disposed adjacent and parallel to the bi-metal. The heating element 70 is positioned and held in place by its leads 72 and 74 which terminate at board 20. The bi-metal member is of a type which, when heated, bows toward the abutting screw 38. Such a bow causes the bracket 30 to pivot about the shaft 32 which in turn rocks the gear 46 (against the bias of spring 52) into meshing engagement with gear 29 of the timer.

Disposed in the space between plates 14 and 16, and near the lower end 41 of the shaft 40, is a collar 78 which carries an outwardly extending abutment screw 80, which is angularly displaced (in plan view) from the abutment screw 38. A bracket 82, extending between plates 14 and 16, pivotally supports a switch plate 84 in a plane substantially normal to the bi-metal member 60. Disposed on opposing sides of the switch operating plate 84, at each end thereof, is a pair of switches 86 and 88 having operating arms 90 and 92 respectively extending toward the ends 94 and 96 of the switch operating plate. A pair of adjustable screws 98 and 100, carried by the switch operating plate 84, are arranged to contact the switch arms for simultaneously turning both switches off or on as the plate is pivoted.

A schematic of the photo cell 24 is shown in FIG. 6. It is of a cadmium-sulfide type. When the cell active element 24a is illuminated, its resistance is low and power will flow to the photo-cell switch heating element 24b. The photoswitch contact arm 24c is mounted on a bi-metal element and, when heated, causes an open circuit condition. When normal daylight falls to a level of approximately five foot candles, the cadmium-sulfide cell resistance rises to a point where insufficient power is supplied to the photoswitch heater element 24b and the contact 24c will complete the circuit to line 72.

Such action applies current to the heater resistor 70, to motor 25, and to the lighting loads via the normally closed contacts of switches 86 and 88. As the heater element 70 becomes hot, the bi-metal 60 begins to bow against screw 38. This force in turn produces a rotational torque on rocker bracket 30 which pivots about the stud shaft 32. The upper end of shaft 40 thus carries gear 46 into mesh with the timer gear 29. Firm engagement of the gear teeth prevents further deflection of bi-metal 60, but continued heating takes place, and this additional energy is used to develop high tooth mesh force between the gears,

When the gear teeth are in mesh, shaft 40 rotates since power has been applied to the timer motor 25. After a predetermined time interval, abutment screw 80 will bear against switch operator plate 84 causing it to pivot about bracket 82. For ease of description, only switch 86 is shown. Those skilled in the art will readily recognize that the switch 88, adjacent the other end of the control plate, can control a second load in an identical manner. The switch plate 84 continues to pivot until the set screws 98 and 100 drive the arms 90 and 92 into an open circuit position. The screw 98, bearing against the switch 86, is set to cause switch 86 to assume the open circuit position slightly after switch 88 opens. This adjustment assures that switch 86 will not open first, thus stopping the motor before switch 88 opens.

As can be seen the total "on" time for switches 86 and 88 is determined by the angular displacement between the abutment screws 48 and 80. The larger this angle, the shorter will be the switch "on" time. A simple calibrated dial (on the upper surface of plate 14) in the vicinity of screw 80 will permit a setting for any desired number of hours. For practical reasons, the calibrated plate shows hour graduations starting at 3 and ending at 9.

After plate 84 moves sufficiently to open switches 86 and 88, power to the timer motor 25 is removed. The elements will remain in this condition for the remaining hours of darkness. When the sun rises, the cadmium sulfide cell will revert to a low resistance and the photo-switch heater 24b is heated thereby opening the photo-switch contact 24c. This in turn removes power from the heating element 70 and the bi-metal strip 60 begins to cool. As bi-metal strip 60 cools, it assumes its unheated, straight position, thereby removing force on rocker bracket 30. As shaft 40 is rotated by the timer motor, the spring 52 is elongated and energy is stored therein. The spring 52 produces a nearly constant resetting torque regardless of the angular difference time-setting between screws 48 and 80.

As bi-metal 60 continues to cool, spring 52 rocks bracket 30 causing gears 46 and 48 to disengage. The instant the teeth separate, spring 52 snaps screw 48 back to the reference position against stop lug 56. The mechanism is now completely reset and waiting for dusk to once again repeat the entire cycle.

FIGURE 9 discloses another embodiment of the invention wherein additional loads are controlled. Rotating signs have become very popular, and it is desirable to have such a sign rotating during daylight hours and that period of darkness when the sign is burning. It is, of course, desirable to have the stop sign rotating during those night-time hours in which the sign lights are not receiving power.

In the FIGURE 9 embodiment, additional loads L2 and L3, as well as sign rotating motor RM, have been added to the circuitry. In this instance the photo-electric switch 24 is of a double throw type having a first line 101 connecting with line 74, and a line 103 connecting with load L3. The other lead line 102 of the photo-electric switch leads to the load L2. A direct line 105 leads from the main power source to the rotating motor RM, and is under the further control of a switch extension 90' of switch 86.

For ease of understanding the purpose of such an arrangement it can be assumed that the load L is the timed-off load previously discussed, that L2 is a day time load, such as an air conditioner fan or the like, L3 is a dusk-to-dawn load, such as security lights, flood lights, or the like, and RM is a rotator motor which requires power during the daylight hours and during the time the load L is burning.

During daylight periods the resistance in element 24a is low and consequently current through 24b maintains the switch arm 24c in engagement with the line 102 and, therefore, the L2 load receives power during daylight

hours. Upon the arrival of darkness, switch arm 24c disconnects power from L2 and is engaged with terminal line 101, which immediately provides power to L3, to heater resistor 70, and to timer motor 25. As in the embodiment of FIGS. 1-8, heater 70 bends bi-metal 60, the bracket 30 rocks gear 46 into engagement with gear 29, and power to motors 25, RM, and load L remains powered until arm 80 causes switches 86 and 90' to disengage.

Power is therefore removed from the load L, the timer motor 25, and the rotator motor RM, but remains connected to security lights L3. Upon 24a sensing dawn, arm 24c re-engages terminal 102, screw 80 is moved out of engagement with plate 94, and the unit is again ready for operation. It can be seen that the rotator motor RM receives power through line 105 at all times except for that period in which contact 80 is in engagement with the switch plate 94. This period extends from the time L is disconnected and L2 is connected.

In a general manner, while there has been disclosed in the above description, what is deemed to be the most practical and efficient embodiment of the invention, it should be well understood that the invention is not limited to such an embodiment as there might be changes made in the arrangement, disposition, and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

I claim:

1. A device for the daily control of an outdoor sign, including a power source receptacle, a load, and circuitry connecting said source to said load, that improvement comprising a first switch normally open for interrupting said circuit between said load and said source, means to close said switch upon a decrease in illumination, a second normally closed switch between said first switch and said load, a timer unit operatively connected to said second switch, second means to activate said timer upon the closure of said first switch, and third means for opening said second switch after a preselected length of time of operation of said timer unit.

2. A device for the daily control of an outdoor sign, including a power source receptacle, a load, and circuitry connecting said source to said load, that improvement comprising a first switch normally open for interrupting said circuit between said load and said source, a photo-electric device for closing said switch upon a decrease in illumination, a second normally closed switch between said first switch and said load, a timer unit operatively connected to said second switch, means to activate said timer upon the closure of said first switch, second means for opening said second switch after a preselected length of time of operation of said timer unit, and third means to re-close said second switch and re-open said first switch when said photo-electric device is again illuminated.

3. A device for the daily control of an outdoor sign, including a power source receptacle, a load and circuitry connecting said source to said load, that improvement comprising a first switch normally open for interrupting said circuit between said load and said source, a photo-electric device for closing said first switch upon a decrease in illumination, a heating unit receiving current when said first switch is closed, a normally closed second switch between said first switch and said load, a timer unit operatively connected to said second switch, said heating unit including means to activate said timer upon receiving current therethrough, and to open said second switch after a preselected length of time of operation of said timer unit.

4. A device for the daily control of an outdoor sign, including a power source receptacle, a load, and circuitry connecting said source to said load, that improvement comprising a first switch normally open for interrupting

said circuit between said load and said source, a timer unit, a second normally closed switch between said first switch and said load, a photo-electric device closing said first switch upon a decrease in illumination, a heating unit connected to said source when said first switch is closed, a bi-metal member adjacent said heating unit, means operated by said bi-metal for activating said timer unit, and second means for opening said second switch when there is no current through said heating unit.

5. A device for the daily control of an outdoor sign, including means to receive a power source, a load, and circuitry connecting said source to said load, that improvement comprising a normally open photo-electric switch for interrupting said circuit between said load and said source when said switch is subject to illumination and for closing said switch upon a decrease in illumination, a heating unit receiving current when said first switch is closed, a bi-metal disposed adjacent said heating unit, a normally closed switch between said first switch and said load, a timer unit, a gear output depending from said unit, a gear input for opening said normally closed switch, means actuated by the heating of said bi-metal for engaging said gear input with said gear output.

6. A device for the daily control of an outdoor sign, including means to receive a power source, a load, and circuitry connecting said source to said load, that improvement comprising a first normally open photo-electric switch for interrupting said circuit between said load and said source when said switch is subject to illumination and for closing said first switch upon a decrease in illumination, a heating unit receiving current when said first switch is closed, a bi-metal disposed adjacent said heating unit, a normally closed second switch between said first switch and said load, a timer unit, a rotating gear output depending from said timer unit, a mating gear disposed adjacent said rotating gear, means actuated by the heating of said bi-metal for meshing said rotating gear with said mating gear, and a linkage rotatable with said mating gear for opening said second switch.

7. A device for selectively connecting a power source to a plurality of loads consisting of a first load, a second load, a third load, and a fourth load comprising a timing unit operable for a selected length of time, a photo-electric cell for developing a dawn signal and a dusk signal, first means responsive to said dusk signal for connecting said first load, said second load, said timing unit, and said third load to said power source, said timing unit including a linkage for disconnecting said unit, said first load and said second load from said power source after said selected period of time, and second means responsive to said dawn signal for connecting said second load and fourth load to said power source and disconnecting said third load.

8. A device for selectively and automatically connecting a power source to a plurality of loads consisting of a first load, a second load, a third load, and a fourth load comprising a timing unit operable for a selected length of time, a photo-electric cell for developing a dawn signal and a dusk signal, a linkage including a bi-metal responsive to said dusk signal for connecting said first load, said second load, said timing unit, and said third load to said power source, said timing unit including a mechanical connection for disconnecting itself and said first and second loads from said power source after said selected period of time, and a switch responsive to said dawn signal for re-connecting said second load and connecting said fourth load to said power source and disconnecting said third load.

No references cited.

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