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Misencik

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[54] **PHOTOCONTROL WITH AUTOMATIC LIGHT OPERATED RESET**

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[52] **U.S. Cl.** **317/124;** 219/502; 337/73; 337/258

[51] **Int. Cl.** **H01h 47/24**

[58] **Field of Search** 219/502; 317/124; 337/3, 337/13, 70, 72, 356, 358, 73

[56] **References Cited**

UNITED STATES PATENTS

2,875,348	2/1959	Kazan	219/502 X
3,048,833	8/1962	Bernheim	317/124 X
3,416,117	12/1968	Grosse-Brauckmann	337/358

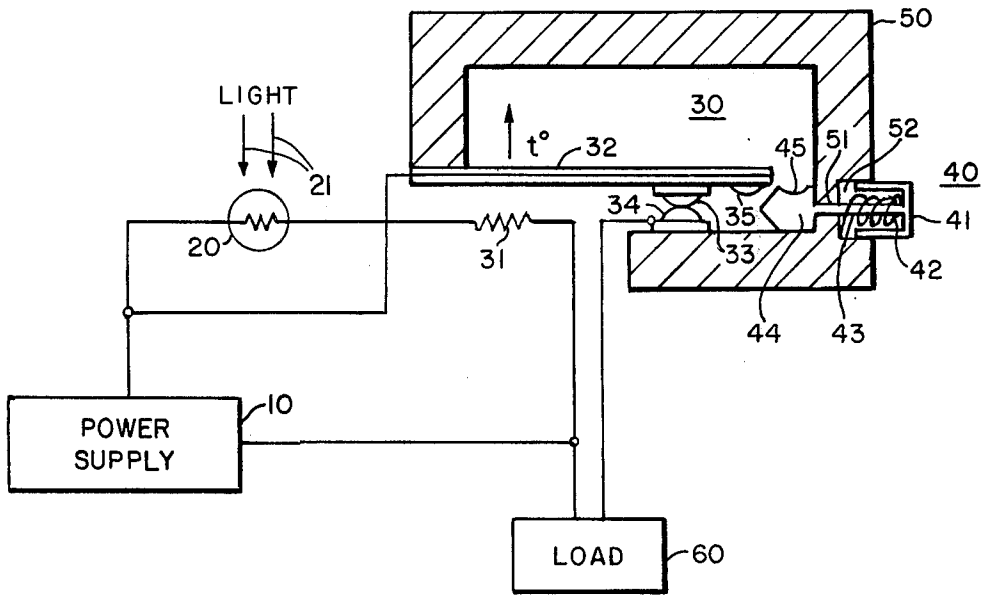
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[57] **ABSTRACT**

A photocontrol is provided with manual interruption and automatic reset. In the photocontrol, a photosensitive resistor controls operation of a thermal switch which in turn controls power to a load. The load circuit is manually interrupted when a spring-loaded actuator is lodged between the thermal switch contacts. Reset is obtained when ambient light rises above a predetermined level and causes the thermal switch to deflect thereby releasing the actuator which is forced by a spring to its original position. The thermal switch contacts are then free to open and close in response to the rise and fall of ambient light level.

7 Claims, 3 Drawing Figures



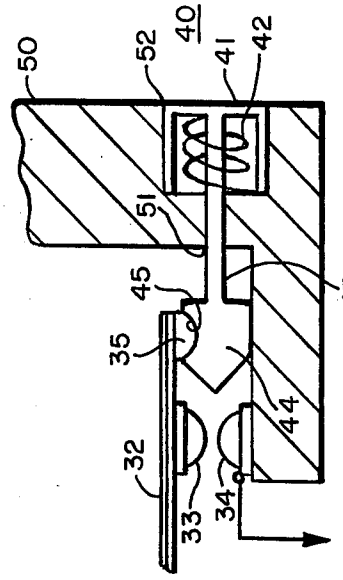


FIG. 2

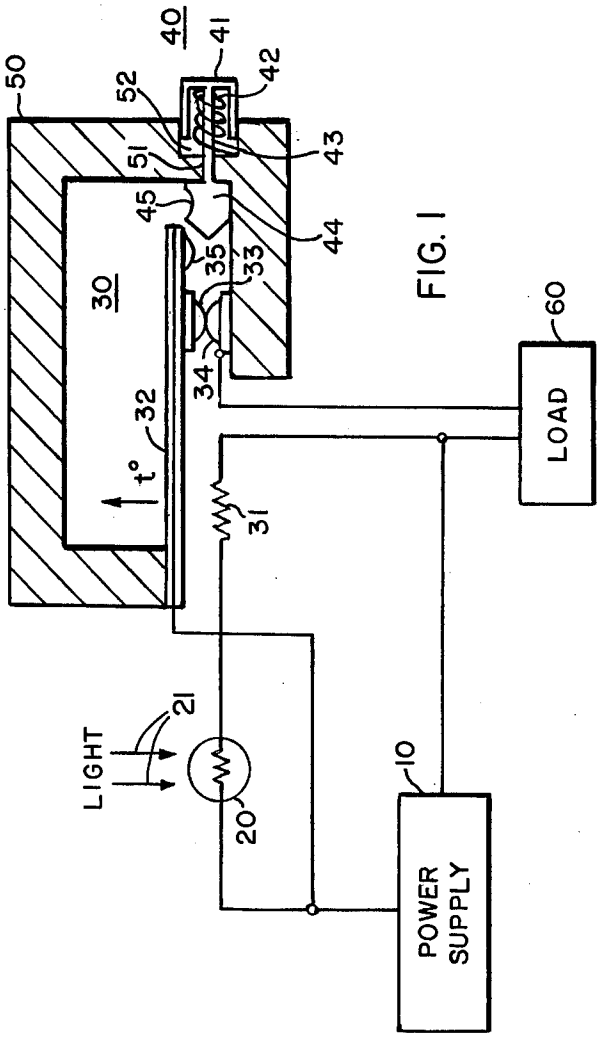


FIG. 1

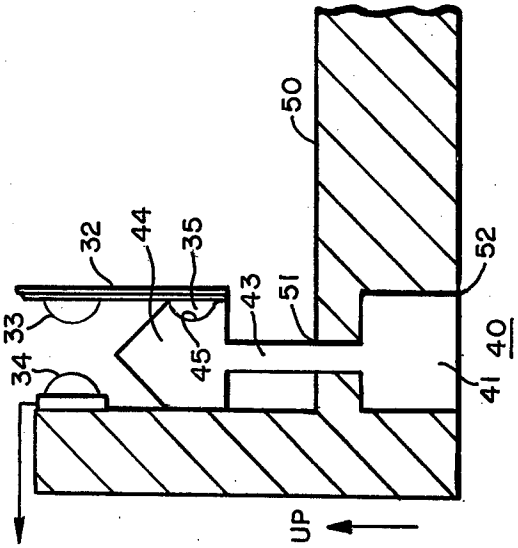


FIG. 3

PHOTOCONTROL WITH AUTOMATIC LIGHT OPERATED RESET

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to photocontrol systems and more particularly to automatic resetting light sensitive switches.

2. Description of the Prior Art

Photocontrol devices are well known in the art and are widely used in automatic control applications. Prior photocontrols generally employ a photosensitive resistor in combination with a current-sensitive or heat-sensitive switching element to operate a circuit when the illumination level falls or rises. Typically, as ambient light rises above a specified level, the photosensitive resistor passes current in response to incident light which actuates a relay or an electronic switch. Alternatively, the current output is used to excite a heat generator, such as a carbon resistor, which in turn actuates a thermal switch. Then as ambient light falls below a specified level the switching element is de-energized and the control cycle is completed.

Such prior art arrangements are adequate for applications which require the load to be energized throughout the entire period of darkness, as for example, where streetlights are required to be on all night for safety purposes. But for other applications, such as home lighting systems, it is desirable for reasons of convenience and economy as well as safety to be able to manually interrupt the energized load at will before it is switched off automatically. This, of course, could be accomplished in conventional photocontrolled switch arrangements by utilizing an auxiliary switch in series with the load, but would necessarily defeat the automatic operation of the photocontrol.

Therefore, there is needed a simple photocontrolled switch which may be manually interrupted at will, and which will reset after being manually interrupted.

By way of further background, reference may be made to Kazan U.S. Pat. No. 2,875,348, Feb. 24, 1959, for a description of a thermal switch assembly of the general type to which the present invention applies. However, no prior art photocontrol is known with the automatic reset function provided by this invention.

SUMMARY OF THE INVENTION

The present invention provides flexibility in the operation of photocontrolled switches. Despite the utility of prior art switches as mentioned above, it is desirable in certain applications to be able to manually disable the photocontrolled switch in such a manner that it will automatically reset in response to change in light level. Accordingly, the principal object of this invention is to provide a photocontrolled switch with simple means for interrupting the control sequence and with simple means for automatic resetting to photocontrolled operation in response to change in light level.

The invention provides these advantages in a system which includes a source of electrical power, an electrical load, and an electrical circuit which transfers power from the source to the load. Power is transferred in photocontrolled operation when illumination, which alternately increases and decreases with the passage of time, falls below a predetermined level. Means are provided for opening and closing the power transfer circuit indefinitely and without human supervision such that the power transfer circuit is closed as the illumination falls below a predetermined level and is opened as the illumination rises above the predetermined level. Manual interruption means are provided for opening the power transfer circuit and causing it to remain in circuit open condition during the period that the illumination remains below the predetermined level. Means are provided for automatic reset to photocontrolled operation such that the manual interruption means become disabled as the illumination rises above the predetermined level, thereby allowing the power transfer circuit to return to circuit closed condition without human supervision as the illumination subsequently falls below the predetermined level.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation view, in section, of a preferred embodiment of the invention, including a schematic representation of a circuit in which it may be employed.

FIG. 2 is an enlarged view of a portion of FIG. 1 illustrating a manually operated mechanical actuator.

FIG. 3 illustrates a second embodiment of a manually operated mechanical actuator.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Throughout the description which follows like reference characters refer to like elements on all Figures of the drawing.

A preferred embodiment of the present invention is illustrated in FIG. 1 which shows a photosensitive device **20** connected in series electrical circuit relationship with a power supply **10** and a heat generating resistor **31.** Heat generated in the resistor **31,** which is controlled by the light received by photosensitive device **20,** is utilized to operate a thermal switch **30** for controlling the power transferred from the power supply **10** to a load **60.** When the light, indicated by arrows **21,** impinging upon the photosensitive device **20** reaches a certain predetermined level, the thermal switch **30** closes an electrical circuit and current flows from power supply **10** through the photosensitive device **20** and the heat generating resistor **31** and back to the power supply **10.**

The photosensitive device **20** is arranged to receive light from a specified source whose intensity alternately increases and decreases with the passage of time. In order to control the operation of a thermal switch **30,** photosensitive device **20** passes current from power supply **10** to heater resistor **31** when incident light exceeds a predetermined level. In its ideal configuration photosensitive device **20** has infinite resistance to the flow of current in the absence of incident light and zero resistance in the presence of a predetermined level of light. It should be understood that while these limits may not be realizable in practice, the required function may be satisfied by a conventional cadmium sulfide photocell which exhibits relatively small resistance in the presence of light and relatively large resistance in the absence of light.

The thermal switch assembly **30** includes a heater resistor **31** which is disposed in a thermally coupled relationship with a bimetal strip **32,** which is designed to flex in response to heat. The switch assembly **30** comprises a stationary contact **34** and a contact **33** carried by the bimetal strip **32.** The contacts **34** and **33** are

opened and closed by the flexing of the bimetal strip **32** to connect or disconnect the load **60** with the power supply **10.**

The bimetal strip **32** is arranged in cantilever fashion with one end attached to a housing **50** while the other end carries the electrical contact **33** and a latching portion **35.** The first electrical contact **33** is carried by the bimetal strip **32** and is disposed to engage the second electrical contact **34,** the second electrical contact **34** being mounted on the housing **50.**

A heater resistor **31** is connected in parallel circuit relationship with the load **60** and both the heater resistor **31** and the load **60** are energized by the power supply **10.** This apparatus is operative without regard to the magnitude or character of the load **60,** but the heater resistor **31** must be of relatively high resistance to generate sufficient heat from the available control current to cause the bimetal strip **32** to flex and operate the contacts **33** and **34.** Further, the current rating of the photosensitive device **20** should exceed the maximum current required by the heater resistor **31** to actuate the bimetal strip **32.**

During normal photocontrolled operation the predetermined light level is detected by the photosensitive device **20** which passes current from the power supply **10** in response to the incident light. As light received by photosensitive device **20** increases, the resistance of photosensitive device **20** diminishes thereby allowing greater current flow through the heater resistor **31.** Increased current flow through the heater resistor **31** generates heat which causes the temperature of thermally coupled bimetal strip **32** to rise. When actuating temperature which corresponds to the predetermined light level is reached the bimetal strip **32** bends away from heater resistor **31,** and in doing so disengages contact **33** from contact **34** thus deenergizing load **60.** As the light level subsequently decreases, the resistance of photosensitive device **20** increases to the point that sufficient current is no longer passed to heater resistor **31** to maintain the bimetal strip **32** above its actuating temperature; thus, contact **33** is moved by the bimetal strip **32** as it relaxes to engage contact **34** and thus load **60** is energized. This sequence is repeated indefinitely as the illumination received by the photosensitive device **20** alternately increases and decreases about the predetermined reference level. It should be noted that because of the time required to heat the bimetal strip **32** to actuating temperature and for the bimetal strip **32** to deflect away or move toward the heater resistor **31,** the photocontrol will respond only to light levels which are sustained above or below the predetermined level for a period of time greater than the switching time of the bimetal strip **32.** Thus light fluctuations which occur more rapidly will have no effect on the photocontrol.

A manually operable mechanical actuator assembly **40** is provided for opening the contacts **33** and **34** at any desired time, and the actuator **44** locks the contacts in open circuit position until the level of the light received by the photocontrol device **21** reaches a predetermined level. When the light reaches the predetermined level the actuator **44** is returned to its original, or non-locking position.

The mechanical actuator assembly **40** includes a coiled spring **42** which is attached to housing **50** and surrounds an actuating arm **43** of a pushbutton **41.** The housing **50** aligns the actuator **44** with the latching portion **35** of the bimetal strip **32** so that the latching portion **35** of the bimetal strip **32** engages the actuator **44** and interlocks with actuator cavity **45** when coiled spring **42** is fully depressed. Actuating arm **43** extends through a channel **51** of housing **50** to rigidly connect actuator **44** with the pushbutton **41.** The actuator cavity **45** is a concave depression which generally conforms with and is adapted to receive the latching portion **35** which is generally hemispherical in form and is adapted to fit within the actuator cavity **45.** The actuator **44** and the latching portion **35** are both nonconducting members fashioned from suitable insulating material.

In photocontrolled operation actuator **44** is fully retracted against housing **50** and makes no physical contact with bimetal strip **32** or latching member **35** so that contacts **33, 34** may open and close freely in response to the received light level. However, when it is desired to override normal photocontrolled operation, actuator **44** is manually positioned between housing **50** and bimetal strip **32** by pushing on the pushbutton **41** until the latching portion **35** interlocks with actuator cavity **45.** In this position of the actuator **44** the contacts **33, 34** are held in circuit open position and load **60** is de-energized. The actuator **44** is held in place between latching portion **35** and housing **50** by the compressive force exerted by the bimetal strip **32** as it is displaced from its relaxed, circuit closed position. In this position of the actuator **44,** the coiled spring **42** is fully compressed and exerts a constant retracting force against the pushbutton **41** which lies flush within the actuator recess **52** of housing **50,** but is not strong enough to overcome the binding force exerted by bimetal strip **32** as it holds actuator **44** in its interlocked position with latching portion **35.**

Interruption of the circuit to the load **60** is maintained until such time as light received by the photosensitive device **20** rises to a level sufficient to cause the heat generating resistor **31** to generate heat which in turn causes the bimetal strip **32** to flex upward and disengage the latching portion **35** from the cavity **45** in the actuator **44.** The compressive force exerted by bimetal strip **32** against the actuator **44** diminishes as the bimetal strip **32** is heated to actuating temperature. Automatic reset is obtained when the bimetal strip **32** deflects away from the heater resistor **31** and latching portion **35** is lifted out of the actuator cavity **45** thus allowing the coiled spring **42** to force the actuator **44** to its fully retracted position. While the actuator **44** rests in its fully retracted position, thermal switch contacts **33, 34** open and close without interference according to the rise and fall of ambient light received by the photosensitive device **20.**

In FIG. **3** a second embodiment of a manually operated actuator assembly **40** is illustrated. This configuration is distinguished by the construction of a pushbutton **41** which eliminates the need for the coiled spring **42** shown in FIG. **2.** Here, the pushbutton **41** is generally cylindrical in form and lies within a cylindrical recess **52.** Pushbutton **41** has sufficient mass to move the actuator **44** to its fully retracted position solely by the force of gravity when the photocontrol is installed with the actuator assembly **40** arranged in an upright position.

When normal photocontrolled operation is interrupted, the actuator **44** is held in place between the latching portion **35** and the housing **50** by the compres-

sive force exerted by the bimetal strip **32**. In this position of the actuator **44**, the mass of pushbutton **41** exerts a constant retracting force against the actuator **44**, but is not strong enough to overcome the binding force exerted by the bimetal strip **32** as it holds the actuator **44** in its interlocked position with the latching portion **35**. The retracting force of gravity exerted against the mass of pushbutton **41** is, however, sufficient to overcome the frictional forces exerted by the walls of housing channel **51** against actuator arm **43** and of actuator recess **52** against the surface of the cylindrical pushbutton **41** so that the actuator **44** is moved to its fully retracted position by the force of gravity as latching portion **35** is lifted out of the actuator cavity **45**.

While there has been shown and described what is at present considered to be the preferred embodiment of the invention, modifications thereto will readily occur to those skilled in the art. It is not desired, therefore, that the invention be limited to the specific arrangement shown and described.

I claim:

1. A photocontrol comprising:

a photosensitive device which passes current when excited by a predetermined light level;

a heat generator which is energized by said photosensitive device;

a bimetal member which moves in response to heat received from said heat generator;

a pair of electrical contacts, one of said contacts being carried by said bimetal member, said contact carried by said bimetal member being moved when light received by said photosensitive device falls below a predetermined level to engage said other electrical contact to close an electrical circuit including a power source and moves when light received by said photosensitive device rises above a predetermined level to disengage said other electrical contact to open said electrical circuit; and

means for locking said pair of contacts in circuit open position, said means being actuated by a predetermined light level to permit said contacts to move to circuit closed position.

2. The photocontrol of claim **1** wherein said means for locking said contacts comprises:

an actuator having a latching portion which is movable to a first position in which said pair of electrical contacts are free to open or close according to the rise or fall of the light level, said actuator being movable to a second position in which said actuator latching portion interlocks with said bimetal member causing said pair of contacts to be held in circuit open position; and

means for releasing said actuator from the second position when light received by said photosensitive device rises above a predetermined level.

3. The photocontrol of claim **2** wherein the means for moving said actuator from the first position to the second position comprises a pushbutton affixed to the free end of said actuator.

4. The photocontrol of claim **2** including means for moving said actuator to said first position after said actuator has been released by said predetermined light level received by said photosensitive device.

5. The photocontrol of claim **4** wherein the means for moving said actuator from the second position to the first position comprises a resilent member affixed to the free end of said actuator which deforms as said actuator moves to the second position, said resilient member being adapted to urge said actuator to the first position as said resilient member recovers its original shape.

6. The photocontrol of claim **5** wherein said resilient member comprises a coiled spring.

7. The photocontrol of claim **4** wherein the means for moving said actuator from the second position to the first position comprises an actuator having sufficient mass to move said actuator to its first position by the force of gravity after said actuator has been released by said predetermined light level received by said photosensitive device.

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