Sept. 27, 1966 P. J. CURTIN 3,275,832

LIGHT SENSITIVE BIMETALLIC CONTROL SWITCH

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Fig. 1

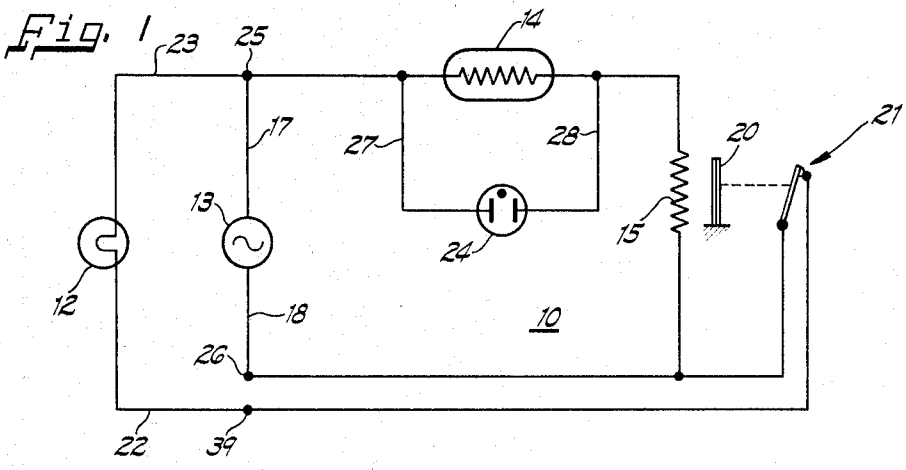


Fig. 5

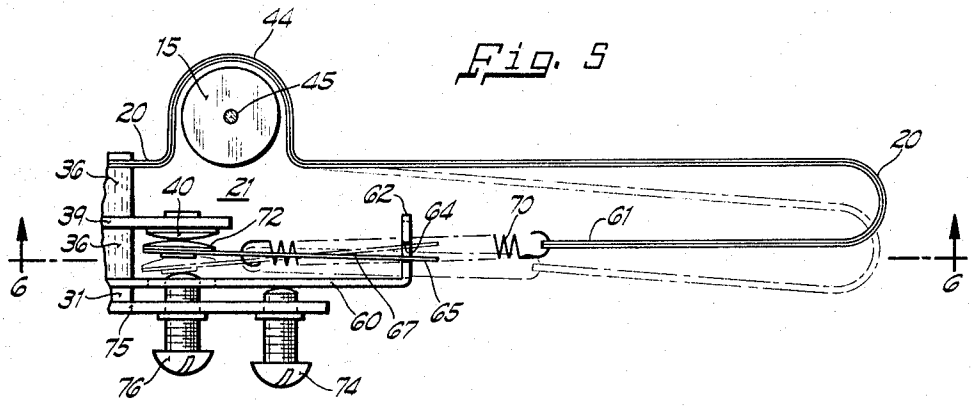
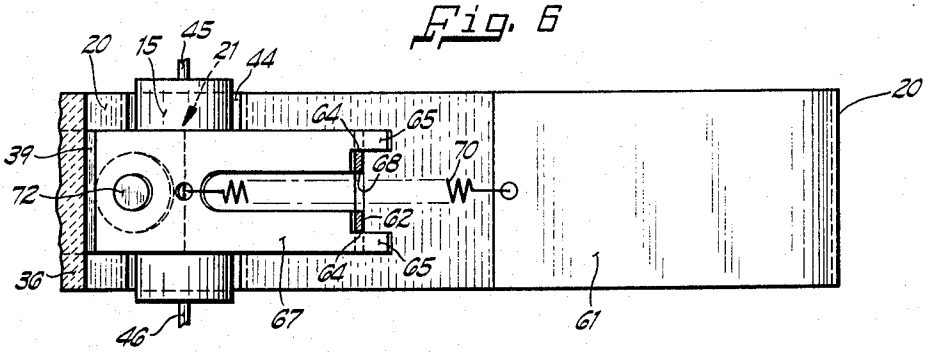


Fig. 6



INVENTOR.
Paul J. Curtin
BY
Fred Wiviott
Attorney

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Fig. 2

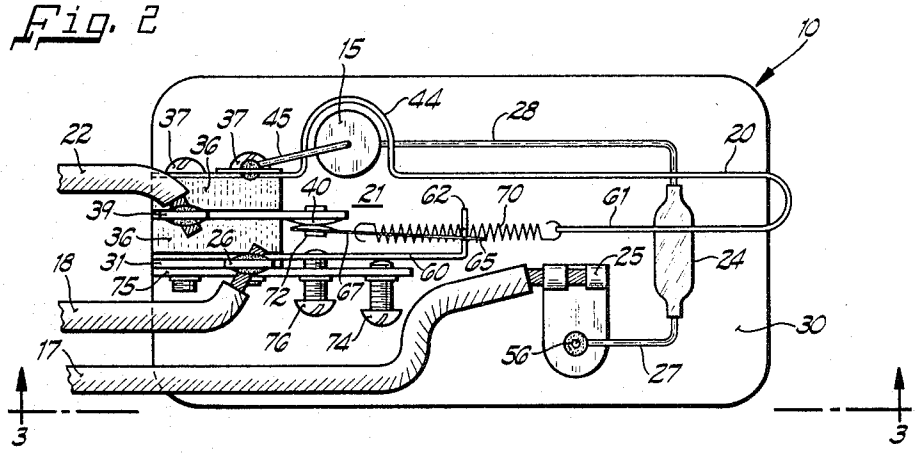
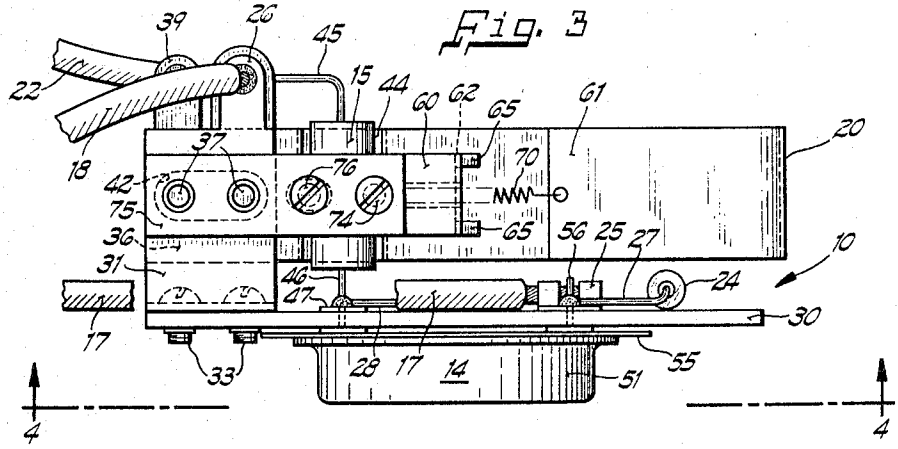


Fig. 3



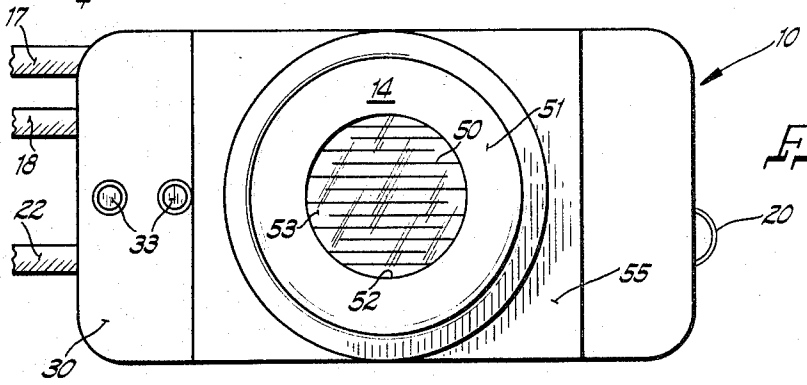


Fig. 4

INVENTOR.
Paul J. Curtin
BY Fred Wiviott
Attorney

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3,275,832

LIGHT SENSITIVE BIMETALLIC CONTROL SWITCH

Paul J. Curtin, South Milwaukee, Wis., assignor to McGraw-Edison Company, Milwaukee, Wis., a corporation of Delaware

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5 Claims. (Cl. 250—206)

This invention relates to light sensitive switches and more particularly to light sensitive control switches for outdoor luminaires of the type employing a light sensitive resistance means for controlling current flow to a heater resistor disposed in close proximity to a switch actuating bimetallic element.

Prior art photo-control devices of the resistance heater type generally employ a fine insulated resistance wire which is wound around the bimetallic switch actuating element. Such windings are costly to manufacture, are structurally weak and are susceptible to surge voltages.

Another shortcoming of some prior art photo-control switches employing cadmium sulfide photo-control elements is that such elements can be damaged by relatively low surge voltages. This is due to the fact that in the absence of light such elements have infinite resistance so that substantially the entire surge voltage on the unit will be impressed across the photo-sensitive element.

It is an object of the invention to provide a photo-control device having a switch actuating bimetallic element which is provided with a bight portion in close proximity to a carbon resistance heater. Another object of the invention is to provide a discharge tube for protecting the photo-sensitive element in such photo-control devices from voltage surges.

A further object of the invention is to provide a photo-control unit with a new and improved resilient overcenter switch. A more specific object of the invention is to provide an overcenter switch for a photo-control device having a fixed contact and a pivotally mounted switch arm which is coupled by resilient means to the free end of a bimetallic element so that flexure of the element in one direction will cause the switch to snap open and flexure in the opposite direction will snap the switch to a closed position.

These and other objects and advantages of the instant invention will become more apparent with the detailed description thereof taken with the accompanying drawings in which:

FIG. 1 is a circuit diagram schematically illustrating the photo-control device according to the instant invention;

FIG. 2 is a top plan view of the photo-control switch according to the instant invention;

FIG. 3 is a view taken along lines 3—3 of FIG. 2;

FIG. 4 is a view taken along lines 4—4 of FIG. 3;

FIG. 5 illustrates the operation of the bimetallic element and the overcenter switch of the device shown in FIG. 2; and

FIG. 6 is a view taken along lines 6—6 of FIG. 5.

Referring now to the drawings in greater detail, FIG. 1 shows the circuitry of the photo-control device **10** operative to connect the lamp **12** being controlled to an energy source **13**. The photo-control **10** includes a cadmium sulfide photo-cell **14** and a heater resistor element **15** which are connected in series with each other and to the energy source **13** by conductors **17** and **18**. A bimetallic element **20** is placed in thermal association with the heater resistor **15** and is operative when sufficiently heated to open a normally closed snap acting switch **21**. When the element **20** is relaxed, the switch **21** is closed to connect the lamp **12** to the energy source **13** through conductors **17**, **18**, **22** and **23**, which are connected as

shown to the input terminals **25**, **26**, and **39** of the control **10**.

The leads **27** and **28** of a neon discharge lamp **24** are respectively connected to the terminals **56** and **47** of the phototcell **14** to provide a shunt discharge path so that if the control device **10** is subjected to surge voltages the tube **24** will break down and by-pass the cell **14**. In this regard, the heater resistor **15** acts as a current limiting resistor to insure that the current flowing through the neon lamp **24** will not be destructively high. In addition, because the resistor **15** can withstand substantially higher surge voltages than wire wound resistors, use of the former eliminates the necessity of additional surge protection across the line terminals as required in some prior art devices.

The control **10** is shown in FIGS. 2, 3, and 4 to include a generally planar base **30** of any suitable insulating material, such as Bakelite, and having a generally L-shaped conductive bracket **31** affixed thereto in any suitable manner, such as by screws **33**. The conductive bracket **31** also carries a terminal member **26** for connection to the line conductor **18**. A pair of insulating blocks **36** are affixed to the bracket **31** by screws **37**. Rigidly clamped between the blocks **36** is a second terminal member **39** which is connected to the lamp wire **22** and which also carries the stationary contact **40** of the snap switch **21**. As seen in FIG. 2, the screws **37** pass through an enlarged clearance hole **42** in the terminal member **39** without engagement therewith so that there is no electrical current path between the terminal member **39** and the bracket **31**. The screws **37** do, however, electrically engage the bracket **31** and also affix one end of the bimetallic element **20** to the insulating blocks **36** opposite the bracket member **31**.

The bimetallic element **20** is shown in FIG. 2 to have a generally U-shaped configuration with a generally semicircular bight **44** formed adjacent its fixed end. The carbon resistor **15** is shown to have a cylindrical configuration and to be disposed parallel to and within the bight **44** and in close proximity of the bimetallic element **20**. The gap between the resistor **15** and the bight **44** may be filled with high temperature silicone grease to improve the transfer of heat therebetween.

The photocell **14** is shown in FIGS. 3 and 4 to include a cadmium sulfide resistor element **50** disposed in a flat circular housing **51** which is suitably affixed to the base plate **30** and has an aperture **52** covered by a transparent crystal **53** for exposing the element **50** to the ambient light. An insulating cloth **55** is disposed between housing **51** and the base plate **30** to provide electrical insulation.

One terminal **45** of resistor **15** is connected to one of the screws **37** so that it is also electrically connected to the supply wire **18** through terminal **26**. The other terminal **46** of the resistor **15** is connected to one terminal **47** of the photocell **14**. The other terminal **56** of the photocell **14** is connected to the terminal member **25** which is also connected to the supply conductor **17**. Thus the current path through the photo-control is from the supply wire **18** to the terminal member **26**, the screw **37**, the heater resistor **15**, the photocell **14**, the terminal member **25** and the supply conductor **17**.

Referring now specifically to FIGS. 5 and 6, an L-shaped conductive bracket member **60** is shown affixed ot the outer surface of the terminal member **26** and extending first toward the free end **61** of the bimetallic element **20** and then at a right angle toward the other side of the U-shaped bimetallic element **20**. A pair of notches **64** are formed in the opposite sides of the end **62** of member **61** for receiving the bifurcated end **65** of a contact arm **67** which carries a contact member **72** at its other end and which forms the movable portion of the switch **21**. In addition, the free end **62** of member **60**

has a central aperture **68** to permit the passage of an overcenter spring **70** which is connected at one end to the free end of the bimetallic element **61** and at its other end to the contact arm **67** at a point adjacent the contact member **72**. The spring **70** urges the bifurcated end of the contact arm **67** into high pressure engagement with the end portion **62** of the bracket **60** to provide good electrical engagement therebetween. When the bimetallic element is in its unflexed position as shown in FIG. 2, the contact **72** carried by the contact arm **67** engages the stationary contact **40** so that a current path is completed between input terminals **26** and **39** through the bracket **60**, contact arm **67**, and the contacts **72** and **40**.

The operation of the snap switch **21** is illustrated in FIG. 5 which shows by full lines the bimetallic element **20** in its unflexed condition and with snap switch **21** closed. This is the condition when the lamp **12** is being energized. Under conditions of darkness, the light impinging on the photocell **14** is insufficient to maintain its resistance at a low level so that the amount of current flowing to the heater resistor **15** is insufficient to cause flexing of the bimetallic element. Should the light level increase sufficiently to cause the resistance of the photocell to diminish, a greater current will flow through the heater resistor **15** causing it to begin flexing the bimetallic element **20**. As the element **20** flexes from its position shown by full lines in FIG. 5 to its position shown by phantom lines, the end of the overcenter spring **70** connected to its free end **61** will begin moving past a line containing the axis of the contact arm **67**. As soon as the center line of the spring passes the axis of arm **67**, the arm will be snapped counterclockwise as viewed in FIG. 5 to move the contact **72** away from the contact **40** thereby interrupting the lamp circuit.

Should the level of illumination decrease, the resistance of photocell **14** will increase to diminish the current flowing through the resistor **15** whereupon it will begin cooling and the bimetallic element will return to its unflexed position. As soon as its free end **61** moves to the point where the center line of the spring **70** passes the axis of the arm **67**, said arm will snap clockwise from its phantom position in FIG. 5 to its full position to close the contacts **72** and **40** and complete the energizing circuit to the lamp **12**.

It will be appreciated that because the heating of resistor **15** and the flexing of bimetallic element **20** do not occur instantaneously the photocell will be immune to transient light changes such as lightning and the like.

The U-shaped configuration of the bimetallic element **20** provides ambient temperature compensation in that any ambient temperature changes which tend to flex the fixed end downwardly as viewed in FIG. 5 will simultaneously cause the free end **61** to flex upwardly so that the net movement of the overcenter spring **70** will be negligible.

In order to calibrate the photocell **10** so that a greater or lesser deflection of the bimetallic element **20** will cause the contacts **21** to be actuated, an adjusting screw **74** is carried by a relatively stiff bracket member **75** which is attached to the terminal **31** in a substantial parallel relation to the bracket **60**. The end of the screw **74** bears against the side of the bracket **60** so that turning of the screw will cause the bracket **60** to flex in one direction or the other thereby moving the end of the contact arm **67** relative to the free end of the bimetallic element **61**. As a result, a greater or lesser amount of deflection of bimetallic element **20** will be required to move the spring **70** overcenter relative to the axis of the arm **67**. A second screw **76** disposed adjacent to the screw **74** acts as a stop for the movable contact **72** so as to adjustably set the length of the contact gap.

While only a single embodiment has been shown and described, it is not intended that the application be limited thereby but only by the scope of the appended claims.

I claim:

1. In a photo-control device having a pair of input terminals, a photo-sensitive resistor and an elongate heater resistor connected in series, said photo-sensitive resistor being characterized by an impedance that decreases with increasing levels of illumination, an elongate bimetallic element fixed at one end and having a generally U-shaped portion, said bimetallic element also having a bight portion adjacent one end of said U-shaped portion and disposed in close proximity to said heater resistor, a snap acting switch having a fixed contact and a contact arm mounted for movement into and out of engagement with said fixed contact, resilient means coupling the free end of said bimetallic element and said contact arm whereby flexure of said bimetallic element in one direction will cause said resilient means to snap said contact arm away from said fixed contact and return movement of said bimetallic element toward its original position being operative to snap said contact arm into a closed position relative to said fixed contact.

2. In a photo-control device having a pair of input terminals, a photo-sensitive resistor and a heater resistor connected in series, said photo-sensitive resistor being characterized by an impedance that decreases with increasing levels of illumination, said heater resistor being of the carbon type and having a substantially cylindrical configuration, an elongate bimetallic element fixed at one end and having a generally U-shaped portion, said bimetallic element also having a bight portion adjacent one end of said U-shaped portion and disposed in close proximity to said heater resistor, a snap acting switch having a fixed contact and a contact arm mounted for movement into and out of engagement with said fixed contact, said switch means being operative when in a closed position to complete a circuit between said input terminals, spring means coupling the free end of said bimetallic element and said contact arm whereby flexure of said bimetallic element in one direction will cause said spring means to snap said contact arm away from said fixed contact and return of said bimetallic element toward its original position being operative to snap said contact arm into a closed position relative to said fixed contact, and discharge means connected in parallel with said photo-sensitive resistor.

3. In a photo-control device having a pair of input terminals, a photo-sensitive resistor and an elongate heater resistor connected in series, said photo-sensitive resistor being characterized by an impedance that decreases with increasing levels of illumination, a bimetallic element having a fixed end and a free end, said bimetallic element also having a bight portion disposed in close proximity to said heater resistor, a snap acting switch including a fixed contact and an elongate contact arm having one end pivotally mounted adjacent the free end of said bimetallic element, said switch means being operative when in a closed position to complete a circuit between said input terminals, spring means extending between the free end of said bimetallic element and said contact arm at a point remote from the pivotal mounting thereof, whereby flexure of said bimetallic element in one direction will cause said spring means to move overcenter in a first direction to snap said contact arm away from said fixed contact and return of said bimetallic element toward its original position being operative to move said spring means overcenter in the opposite direction to snap said contact arm into a closed position relative to said fixed contact.

4. In a photo-control device having a pair of input terminals, a photo-sensitive resistor and a heater resistor connected in series, said photo-sensitive resistor being characterized by an impedance that decreases with increasing levels of illumination, said heater resistor having a substantially cylindrical configuration, an elongate U-shaped bimetallic element having a fixed end and a free end, said bimetallic element also having a bight portion intermediate its ends and disposed in close proximity to said heater resistor, a snap acting switch including a fixed

contact and an elongate contact arm pivotally mounted adjacent the free end of said bimetallic element and extending generally away therefrom, said switch means being operative when in a closed position to complete a circuit between said input terminals, spring means extending between the free end of said bimetallic element and said contact arm at a point remote from the pivotal mounting thereof, whereby flexure of said bimetallic element in one direction will cause said spring means to move overcenter in a first direction to snap said contact arm away from said fixed contact and return of said bimetallic element toward its original position being operative to move said spring means overcenter in the opposite direction to snap said contact arm into a closed position relative to said fixed contact.

5. In a photo-control device having a pair of input terminals, a photo-sensitive resistor and a heater resistor connected in series, said photo-sensitive resistor being characterized by an impedance that decreases with increasing levels of illumination, said heater resistor being of the carbon type and having a substantially cylindrical configuration, a generally U-shaped bimetallic element having a fixed end and a free end, said bimetallic element also having a bight portion intermediate its ends and disposed in close proximity to said heater resistor, a snap acting switch including a fixed contact and an elongate

contact arm having one end pivotally mounted adjacent the free end of said bimetallic element and extending longitudinally away therefrom, said switch means being operative when in a closed position to complete a circuit between said input terminals, spring means extending between the free end of said bimetallic element and said contact arm at a point remote from the pivoted end thereof, whereby flexure of said bimetallic element in one direction will cause said spring means to move overcenter in a first direction to snap said contact arm away from said fixed contact and return of said bimetallic element to its original position being operative to move said spring means overcenter in the opposite direction to snap said contact arm into a closed position relative to said fixed contact, and neon tube means connected in parallel with said photo-sensitive resistor.

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RALPH G. NILSON, *Primary Examiner.*

W. STOLWEIN, *Assistant Examiner.*