# United States Patent

**Crowley et al.**

[15] **3,673,381**

[45] **June 27, 1972**


## [54] THERMOSTATLESS BLANKET CONTROL CIRCUIT


[72] Inventors: **George C. Crowley**, Winnetka; **Gordon S. Carlson**, Northbrook, both of Ill.

[73] Assignee: **Northern Electric Company**, Chicago, Ill.



[22] Filed: **Oct. 26, 1971**

[21] Appl. No.: **192,181**

[52] U.S. Cl. ..... **219/212**, 219/494, 317/41, 317/124, 317/132

[51] **Int. Cl.** ..... **H01h 37/00**

[58] **Field of Search** ..... 317/132, 40 R, 41, 124; 307/117; 219/494, 212



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,356,825 | 12/1967 | Mills et al. | 219/494 X |
| 3,361,941 | 1/1968 | Fickweiler | 317/132 |
| 3,445,631 | 5/1969 | Fickweiler | 317/132 X |



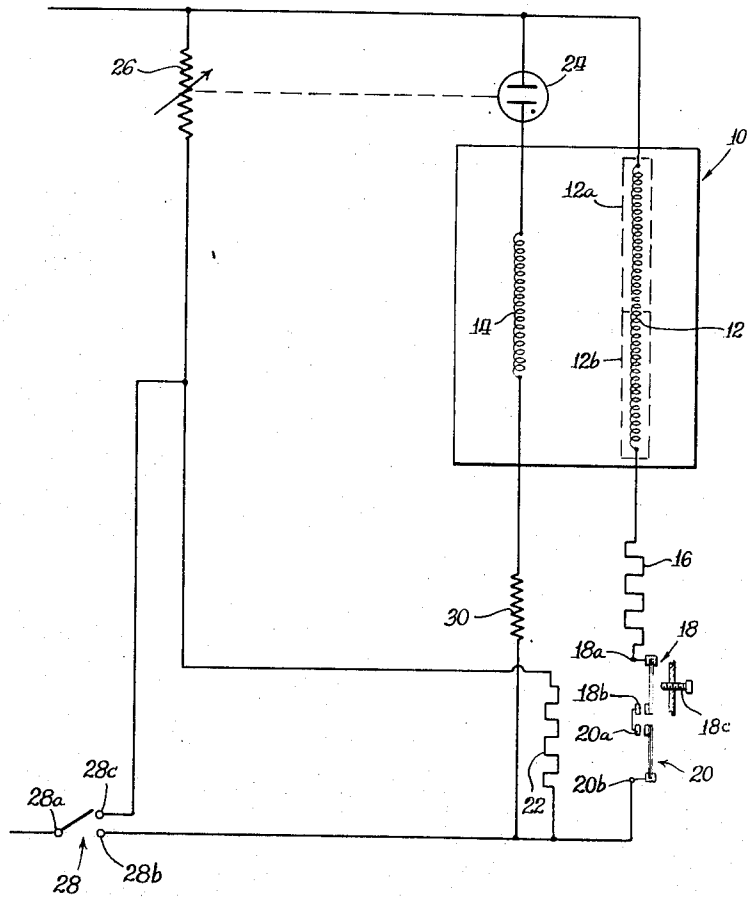
*Primary Examiner*—James D. Trammell
*Attorney*—George R. Clark

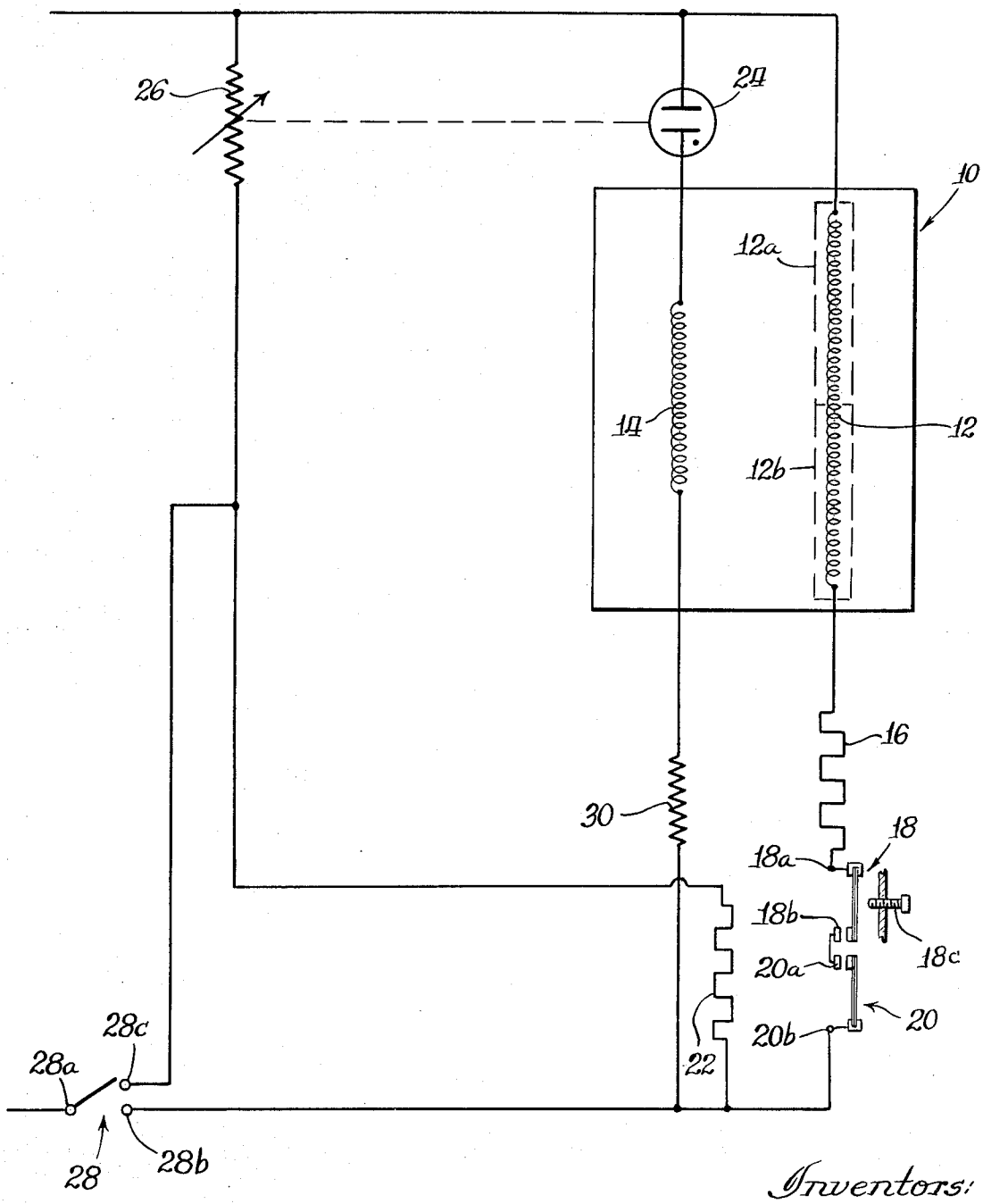


[57] **ABSTRACT**

An overload protection circuit for an electric heating blanket is provided. A sensing element in the blanket is coupled to a neon-filled diode. When an overload condition is sensed the diode ceases to emit light and a bimetallic element in series with a light-responsive resistor causes a pair of contacts in series with the heating element to open.


**6 Claims, 1 Drawing Figure**






Inventors:
George C. Crowley
Gordon S. Carlson
By: Glenn W. Bowen
Atty.

# THERMOSTATLESS BLANKET CONTROL CIRCUIT

## BACKGROUND OF THE INVENTION

Electric heating blankets are commonly constructed with a heat-sensitive sensing wire or element and a heating wire or element. One frequently encountered electric heating blanket construction consists of a flexible insulating core around which the heating wire and sensing wire are wound. The heating and sensing wire are separated by a layer of heat sensitive material. The resistance of the heat-sensitive material varies inversly with the temperature of the heating wire and this variation is sensed by the sensing wire to provide for overload protection. An insulating covering is preferably supplied over the sensing wire.

Control for a blanket of the type described is conventionally achieved by a means of a thermally sensitive switch which has a pair of contacts coupled in series with the heating wire. The sensing wire may be coupled to the control circuit of a second thermally sensitive switch which has pair of overload contacts in series with the heating wire. The second thermal switch provides overload protection for the blanket. The bimetallic thermal control switches which are commonly used to control the operation of the overload contacts are expensive and are capable of handling only a very small amount of power. Moreover, these switches tend to be overly sensitive and are difficult to manufacture.

It is therefore an object of the present invention to provide a relatively inexpensive and uncomplicated thermal overload circuit.

It is another object of the present invention to provide an overload protection circuit for an electric blanket wherein a light source is activated by a sensing wire and a light-responsive switch means is activated by the light source to open the heating wire circuit of the blanket wire.

It is a further object of the present invention to provide an electric blanket control in which a neon-filled diode is coupled in series with a sensing wire so that the neon gas in the diode is de-ionized when an overload condition exists, and in which a light-responsive means reacts to the absence of light from the ionized neon by opening the heating wire circuit.

## DESCRIPTION OF THE DRAWING

The FIGURE is a schematic diagram of an embodiment of the present invention.

## TECHNICAL DESCRIPTION OF THE INVENTION

In order for an electric blanket to be suitable for personal use the blanket must be safe and it must be easy to operate. An electric heating blanket may become overheated during use thereby creating a dangerous risk to the user of the blanket. Therefore, virtually all commercially available blankets provide for some form of overload protection. The various control circuits that are conventionally employed, however, are relatively expensive to manufacture and are relatively difficult to manufacture. A reliable and inexpensive overload control circuit is provided by the present invention.

An electric blanket which incorporates the present invention is indicated by the reference number **10** of the FIGURE. The electric blanket **10** is constructed in a somewhat conventional manner in that it has a heating wire **12** and a sensing wire **14** incorporated therein. The length of the sensing wire is approximately equal to one-half the length of the heating wire **12**, which is shown schematically in the figure by the two half length sections **12***a* and **12***b*. The sensing wire **14** is wound through only one half of the electric blanket **10**, but unlike most sensing wires the sensing wire **14** is able to carry enough electrical current to function as a heating wire also. The sensing wire **14** may be physically located in a portion of the heating blanket with either of the half-length segments of the heating wire in proximity to it. The resistance of the heating section which is in proximity to the sensing wire **14** will be however slightly different from the resistance of the other section of heating wire in order to provide for temperature equalization across the entire heating blanket **10**.



The heating wire **12** is connected in series with the thermal control element **16** of the thermal switch **18** across the input voltage line. The element **16** is a conventional bimetal thermal control element that is responsive to the current that flows through the heating wire **12** and it is adjustable by the user by means of a conventional adjustment screw **18***c*. The switch **18** causes the connection between the points **18***a* and **18***b* to be repeatedly made and broken in a cyclic manner. The length of time that the connection is made during a given time period is determined by the setting of the adjustment screw.

In addition to the control switch **18** an overload switch **20** must be provided to insure that an overload condition does not damage the blanket and possibly result in a dangerous condition for the user of the blanket. When the blanket **10** is energized the overload switch **20** closes the heating wire circuit through the points **20***a* and **20***b* since the On-Off switch **28** is in its On position and electrical connection is also made between the points **28***a* and **28***b*. The bimetallic thermal control element **22** that controls the making and breaking of the switch **20** is coupled to the neon-filled diode **24**. The diode **24** is coupled to the sensing wire **14** which in turn is coupled to the current limiting resistor **30**. The diode **24** is normally energized so that the neon gas in the diode **24** is ionized and the diode **24** is consequently emitting light. The sensing wire **14** is made of a material which has a decreased resistance when its temperature increases. When an overload condition occurs the sensing wire **14** heats up and the resistance of the sensing wire then reduces sufficiently to cause the ionized gas in the diode **24** to be extinguished. When this occurs light will no longer be emitted by the diode **24**. The light emission state of the diode **24** is used in the manner described below to control a light-responsive switch which opens and closes the heating wire circuit and it also may be used to give the user a visual indication of the overload condition if desired.

The current through bimetallic control element **22** controls contacts of the switch **20** which makes and breaks the electrical connection between the points **20***a* and **20***b*. When the neon gas in the diode **24** is ionized, light from the diode **24** is received by the light-responsive resistor **26**, which may be a cadmium sulphide cell or other suitable element. The resistance of the light responsive resistor **26** is such that the current through the bimetallic element **22** causes sufficient heating of the element **22** so that it deflects enough to keep the switch **20** closed thereby completing the circuit between the points **20***a* and **20***b* when the neon gas in the diode **24** is ionized. If overload occurs, however, the absence of emitted light from the diode **24** causes the resistance of the light-responsive resistor **26** to increase sufficiently so that the current through the bimetallic element **22** decreases to the point where the element **22** cools off and deflects in a direction that causes the switch **20** to open the electrical connection between the points **20***a* and **20***b* of the heating wire circuit.

Since the operation of the light-responsive resistor **26** is critical it is desirable to be able to make the overload circuit fail-safe in the event that the resistance of the resistor **26** decreases materially or shorts out. For this purpose the On-Off switch **28** has a contact **28***c* which momentarily contacts the moving contact of the switch **28** when the switch is being turned on. This momentarily places the full line voltage across the resistor **26**, and if the resistance of the resistor **26** is below a predetermined minimum value, it will be burned out causing an open circuit thereby making the overload circuit inoperative to close switch **20**. This arrangement thus prevents energization of the heating elements **12** in the event that the overload circuit is not in condition to operate.

While a particular embodiment of the present invention has been described it is not intended that the invention be limited thereto since many modifications may be made and it is intended to cover any such modification that falls within the true scope and spirit of the appended claims.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. An overload protection circuit for an electric blanket having a heating means and a sensing means which has a re-

sistance that decreases with increasing temperature, the sensing means being located in proximity in said blanket to said heating means and electrically coupled in parallel with said heating means, comprising a diode filled with an ionizable gas which emitts radiation wen said gas is ionized; said diode being coupled in series with said sensing means, control means having a pair of overload contacts which are coupled in series with said heating means and radiation responsive means coupled to said control means and positioned to receive said radiation from said diode; said control means being constructed to control the opening and closing of said overload contacts in accordance with the condition of said radiation responsive means wherein said condition changes in accordance with the radiation received by said radiation responsive means from said diode.

2. An overload protection circuit as set forth in claim 1 wherein said radiation responsive means is a resistor which has a resistance that varies as a function of the radiation said resistor receives from said diode.

3. An overload protection circuit as set forth in claim 2 further comprising a blanket energizing switch means which has contacts that momentarily place line voltage across said resistor when said switch is being changed from its off and its on position.

4. An overload protection circuit as set forth in claim 1 wherein said control means is a bimetallic control element that is coupled in series with said radiation responsive means across said series combination of said diode and said sensing means.

5. An overload protection circuit as set forth in claim 4 wherein said radiation responsive means is a resistor which has a resistance that varies as a function of the radiation said resistor receives from said diode.

6. An overload protection circuit as set forth in claim 5 further comprising a blanket energizing switch means which has contacts that momentarily place line voltage across said resistor when said switch is being changed from its off to its on position.

* * * * *

# UNITED STATES PATENT OFFICE

# CERTIFICATE OF CORRECTION

Patent No. 3,673,381 Dated June 27, 1972

Inventor(s) Crowley et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column, line 25, add--between the sensing wire 14 and the heating wire 12,--after "material"; line 26, add--, and the sensing wire 14--after "increases"; line 27, cancel "wire 14", substitute--material--; line 28, cancel "wire then", substitute--material--; line 28, add--the ionization current through the diode 24--after "reduces".

Column 3, line 5, cancel "wen", substitute--when--.

Signed and sealed this 8th day of May 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334

# UNITED STATES PATENT OFFICE
# CERTIFICATE OF CORRECTION

Patent No. 3,673,381 Dated June 27, 1972

Inventor(s) Crowley et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column, line 25, add--between the sensing wire 14 and the heating wire 12,--after "material"; line 26, add--, and the sensing wire 14--after "increases"; line 27, cancel "wire 14", substitute--material--; line 28, cancel "wire then", substitute--material--; line 28, add--the ionization current through the diode 24--after "reduces".

Column 3, line 5, cancel "wen", substitute--when--.

Signed and sealed this 8th day of May 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334