May 7, 1968 G. LLOYD 3,382,403

ELECTRIC LAMP

Filed July 20, 1965

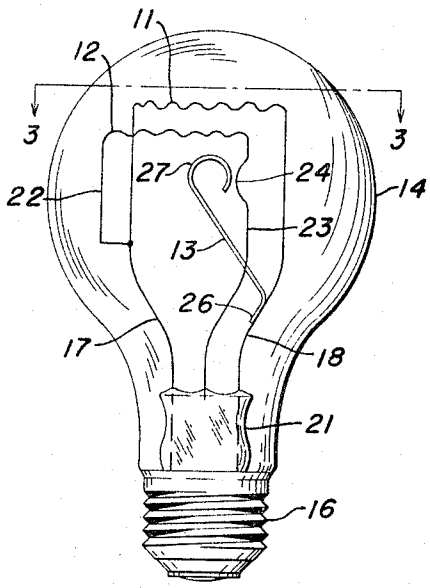


Fig-1-

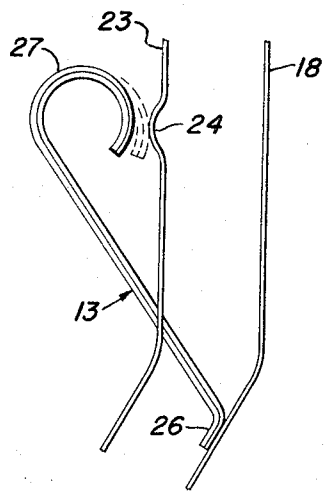


Fig-2-

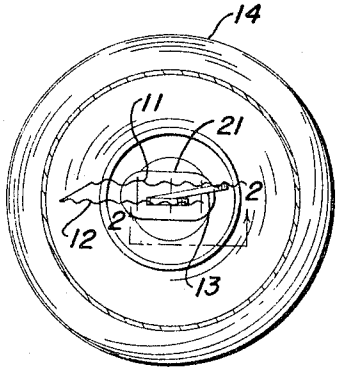


Fig-3-

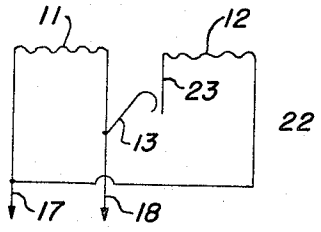


Fig-4-

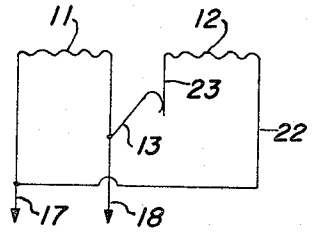


Fig-5-

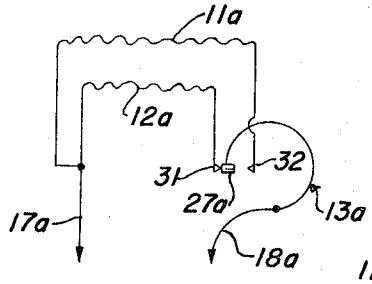


Fig-6-

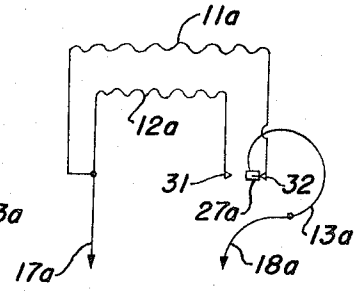


Fig-7-

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ELECTRIC LAMP

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The invention relates to electric lamps and more particularly to constructions thereof capable of indicating a failure of a light emitting element.

There is a great need in many industries and for many applications for an electric light bulb which is absolutely reliable. Such bulbs are used as indicators in a variety of apparatus and systems and failure of an indicator lamp can cause great loss of life and property when the indicator lamp which has failed is relied upon to indicate a condition of a system, part of a system, or condition of a specific group of components. Such uses and applications are very widespread and almost limitless. A few examples include control panels in aircraft, spacecraft and control towers; call lights for police, firemen, hospital personnel; traffic lights; medical and hospital equipment, such as emergency generators, iron lungs, and other electrical or electronic equipment; indicator lamps showing condition of various equipment such as oil and generator warning lights in automobiles, ships or aircraft; and generally any lamp designed to indicate malfunction of any mechanical, electrical or electronic system where damage to equipment, personnel and property may occur.

An object of the present invention is to provide an electric indicator lamp of the character described which has a very high order of reliability and dependability and which will provide a visual signal to the user or operator of the equipment with which the lamp is used of the failure of the primary light emitting element of the lamp so that immediate replacement of the lamp may be effected.

Another object of the present invention is to provide an electric lamp of the character described which can be manufactured in a complete variety of sizes and shapes and base designs used in currently available indicator lamps; and which may be used to replace any existing indicator lamp currently in use directly and without modification of any circuitry.

A further object of the present invention is to provide an electric lamp of the character described which will afford a reduction of time spent in maintenance and repair of equipment in providing an immediate indication of lamp failures, location of failures indicated by lamps, and the prevention and minimizing of inconvenience to customers and personnel using apparatus equipped with the present lamps.

Still another object of the present invention is to provide an electric lamp of the character above which may be manufactured at small additional cost.

The invention possesses other objects and features of advantage, some of which of the foregoing will be set forth in the following description of the preferred form of the invention which is illustrated in the drawing accompanying and forming part of this specification. It is to be understood however, that variations in the showing made by the said drawing and description may be adopted within the scope of the invention as set forth in the claims.

Referring to said drawing:

FIGURE 1 is a side elevation of an electric lamp constructed in accordance with the present invention.

FIGURE 2 is an enlarged fragmentary side elevation of portions of the lamp, the view being taken as indiiated by line 2—2 in FIGURE 3.

FIGURE 3 is a plan sectional view of the lamp taken substantially on the plane of line 3—3 of FIGURE 1.

FIGURE 4 is an electric schematic diagram of the lamp.

FIGURE 5 is an electric schematic diagram of the lamp with the parts shown in a different position.

FIGURE 6 is an electric schematic diagram of a modified form of the lamp.

FIGURE 7 is an electric schematic diagram of the lamp illustrated in FIGURE 6 but with parts in another position.

The electric lamp of the present invention comprises, briefly, primary and secondary light emitting elements 11 and 12; a thermostatically operated switch 13 mounted in position for heating by elements 11 and 12; the elements and switch being connected for normal operation of the primary element 11; and the switch being constructed to automatically move between heated and unheated positions and being connected to make and break electrical connection to the secondary element 12 in its unheated and heated positions respectively, whereby upon open circuiting of the primary element 11 the switch will produce periodic energization and blinking or flashing of the secondary element 12.

As will be seen in FIGRE 1, the several elements of the lamp are enclosed in an envelope 14 which is secured to an appropriate electrical contacting base 16, such as the threaded base here shown, although as will be understood any lamp base may be used.

It will be further seen that the lamp has power input terminals 17 and 18 which are carried by an internal stem 21 supported by base 16. The light emitting elements 11 and 12 are preferably composed of filaments and as will be seen primary filament 11 has its ends here secured to power input terminals 17 and 18 so that the primary filament will be energized whenever electric power is supplied to terminals 17 and 18. Secondary filament 12 has one end secured to a branch terminal 22 secured to input terminal 17 and has its opposite end secured to a rigid supporting electrical conductor 23 which is supported at its lower end in stem 21. An electric circuit is completed through secondary filament 12 by switch 13 which is here connected to input terminal 18 and is mounted to provide in an unheated condition electric contact with a portion 24 of conductor 23. In the present construction switch 13 is preferably composed of an electric current conducting bimetal arm connected at one end 26 to conductor 18 and having an opposite end 27 mounted to swing away from and into electrical contact with portion 24 of conductor 23 when the arm is heated and cooled respectively and shown in full and dashed lines in FIGURE 2.

As will be seen from FIGURES 1 and 3, filaments 11 and 12 are offset from each other and the bimetal switch arm 13 is mounted directly under the filaments for heating thereby. In the unheated condition of the switch arm, electrical connection is made to both the primary and secondary filaments as seen in dashed line in FIGURE 2 and in the electric schematic diagram in FIGURE 5. Thus, initially upon applying voltage to the lamp, both filaments will be energized. Switch arm 13 will then be heated so as to draw away from the switch contact portion 24 of conductor 23 thereby de-energizing the secondary filament but leaving the primary filament energized. The switch arm will be retained in this laterally displaced position so long as the primary filament is energized, but is constructed to return automatically to its unheated position upon open circulating of the primary filament. When this occurs by reason of a failure of the primary filament while voltage is still applied, switch arm 13 will return to its unheated position thereby energizing the secondary filament and to be in turn actuated thereby so as to set up an oscillating pattern of movement causing periodic energizing and blinking or flashing

of the secondary filament 12 which immediately informs any observer that the primary filament in the lamp has failed.

A modified form of the invention is illustrated in FIGURES 6 and 7 wherein the lamp is designed for special and unusual conditions, such as a bank of many lamps operating simultaneously, where the additional power drain caused by both filaments operating for a few seconds immediately after the lamps are energized would be undesirable. In this form of the invention, the primary and secondary filaments 11*a* and 12*a* and the thermostatic switch 13*a* are connected to input terminals 17*a* and 18*a* in a manner causing initial operation of only the secondary filament 12*a* then followed by continuous energization of primary filament 11*a* and de-energizing of filament 12*a*; the design being so arranged that upon open circuiting of filament 11*a* switch 13*a* will produce periodic energizing and flashing of filament 12*a*.

As will be seen from FIGURES 6 and 7 filaments 11*a* and 12*a* are each connected at one end to input terminal 17. The opposite ends of filaments 11*a* and 12*a* are connected to spaced stationary contacts 31 and 32 mounted for engagement with the free swinging end 27*a* of a bimetal switch arm of the same type described in connection with the first embodiment and having its opposite end connected to power input terminal 18. In the unheated condition of bimetal arm 13*a*, end 27*a* will be engaged with contact 31 thus energizing the secondary filament 12*a* upon applying voltage to the lamp. Heat generated by the energization of filament 12*a* will cause arm 13*a* to swing end 27*a* away from engagement with contact 31 and into engagement with contact 32 thus breaking the electric circuit to the secondary filament and making an electric circuit with primary filament 11*a*. Movement of switch arm into engagement with contact 32 after disengagement from contact 31 and de-energizing of filament 12*a* will be caused by thermal inertia of the bi-metal material. Switch arm 13*a* will remain in engagement with contact 32 so long as primary filament 11*a* is energized. When there is a failure of filament 11*a*, the bi-metal switch arm 13*a* cools, as in the first described embodiment, and re-engages contact 31 thereby again energizing secondary filament 12*a* which in turn heats the bi-metal arm driving it to open the electrical connection to filament 12*a*, to then cool and return to make electrical contact, thus setting up an oscillating pattern producing periodic energizing and blinking or flashing of filament 12*a*, thereby furnishing a visual signal of lamp failure.

The most common causes of filament failure in incandescent lamps are sudden surges of overvoltage and aging of filaments due to hours of heat operation. In the present lamp the secondary filament is de-energized during normal operation and is not normally subject to sudden voltage increases since it is only in operation for a few seconds at the beginning of each use. However, even a sustained overvoltage would only result in a change in the oscillating pattern. The increase in voltage would cause more heat of the secondary filament and thereby cause a more rapid movement of the thermostatic switch resulting in a shorter exposure to the overvoltage. Consequently, the secondary filament can be relied upon to remain in good operating condition until long after the primary filament has failed.

The flashing rate of the present lamp can be controlled where desirable by four principal factors, viz., the type of bi-metal material chosen, the tension of the bi-metal arm, the opposition of the bi-metal arm in relation to the filaments, and the filament voltage. By way of example, the secondary filament may have an on time of a fraction of a second, say something in the order of $\frac{1}{10}$ second, and a somewhat longer off time, say something in the order of ½ second. These times are only indicative and may, of course, be widely varied to suit the needs or desires of the user.

As will be also observed, the present lamp may be manufactured at minor additional cost since the additional cost of component materials is small and the manufacturing techniques are similar to those now used and not critical.

I claim:

1. An electric lamp comprising, primary and secondary electrically energized light emitting elements, a thermostatically operated switch mounted for heating by each of said elements, and for driving thereby to a heated position, said elements and switch being connected for normal operation of only said primary element, said switch being constructed to move automatically between said heated position and an unheated position and being connected to make and break electrical connection to said secondary element in said unheated and heated positions respectively, whereby upon open circuiting of said primary element said switch will produce periodic energization and blinking of said secondary element.

2. An electric lamp comprising, power input terminals, primary and secondary filaments each having one end connected to one of said terminals, a thermostatically operated switch mounted for heating by each of said filaments, and driving thereby to a heated position, said filaments and switch being connected to the other of said terminals for normal energizing of only said primary filament, said switch having a normal unheated position making connection to said secondary filament for energization thereof and being displaced in said heated position breaking said connection, said switch being retained in heated position so long as said primary filament is energized and being constructed to automatically return to first position upon open circuiting of said primary filament so as to energize said second filament and in turn to be actuated thereby in an oscillating pattern causing blinking of said secondary filament.

3. An electric lamp comprising, power input terminals, a primary electrically energized light emitting element connected to said terminals, a secondary electrically energized light emitting element connected to one of said terminals, a thermostatically operated switch connected to the other of said terminals and being mounted for heating by each of said elements when energized and having a normal unheated first position making connection to said secondary element for energization thereof and being driven thereby to a second heated position breaking said connection, said switch being constructed to automatically return to first position upon cooling whereby upon open circuiting of said primary element said switch will produce periodic energization and blinking of said second element.

4. An electric lamp comprising, primary and secondary electrically energized light emitting elements, a thermostatically operated switch mounted for heating by each of said elements when energized and being driven thereby from a normal unheated position to a spaced heated position, said switch being connected to energize said secondary element in unheated position and to energize said primary element in heated position and being constructed to automatically return to unheated position upon cooling.

5. An electric lamp comprising, power input terminals, primary and secondary filaments each having one end connected to one of said terminals, a thermostatically operated switch connected to the other of said terminals and being mounted for heating by each of said filaments when energized and being driven thereby from a normal unheated position to a spaced heated position, said switch being connected to energize said secondary filament in said unheated position and being connected to energize said primary filament in said heated position, said switch being retained in heated position so long as said primary filament is energized and being constructed to automatically return to unheated position upon open circuiting of said primary filament so as to energize said second

filament and in turn to be actuated thereby in an oscillating pattern causing blinking of said secondary element.

6. An electric lamp as characterized in claim 5 wherein said switch is composed of an electric current conducting bi-metal arm connected at one end to said other terminal and having an opposite end mounted to swing into electrical contact with said primary and secondary filaments when said arm is heated and cooled respectively.

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