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LAMP BURN OUT MONITORING DEVICE

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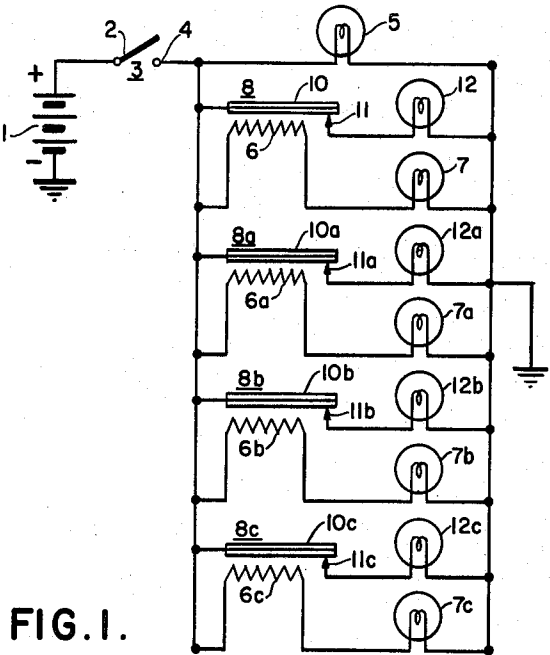


FIG. 1.

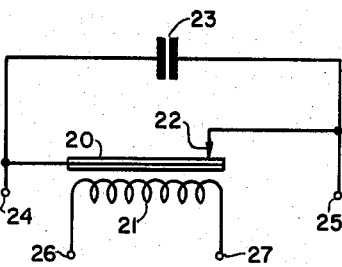


FIG. 2.

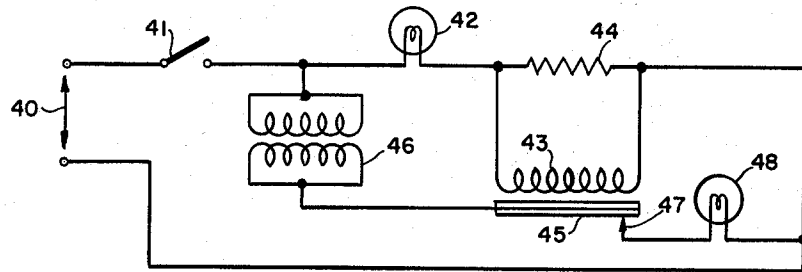


FIG. 3.

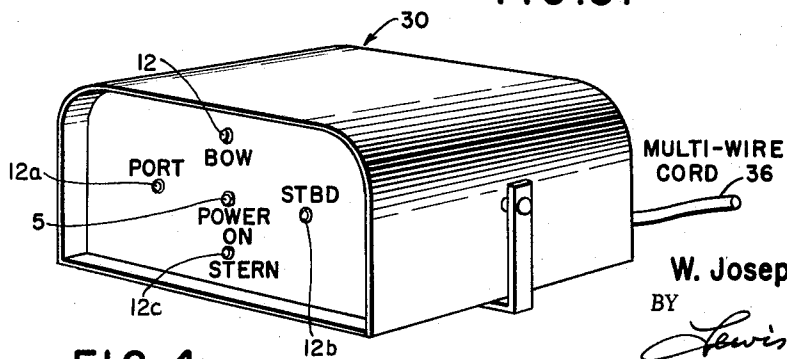


FIG. 4.

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LAMP BURN OUT MONITORING DEVICE

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3 Claims. (Cl. 340-85)

This invention relates to an indicator device for multiple lamp electrical lighting systems. It provides visual means for separately indicating the operative or inoperative condition of each light in the system at a common location remote from the various positions of the lights in the system.

There are many lighting systems, particularly running lights for vehicles, such as boats, airplanes and trucks, in which the indicator device of the invention is particularly useful and advantageous. In any vehicle, whether of the land, sea or air type, safety regulations require that running lights be kept in working order at all times to eliminate the hazard which the vehicles would otherwise create when moving in the dark. Visual checking of each light in these vehicular lighting systems is usually made before getting under way, and perhaps periodically, although not without inconvenience. Obviously, however, such visual checks cannot be made constantly.

By my invention, the pilot or driver is constantly presented with means visible from his position at the controls which indicates at a glance the condition of each running light carried by the vehicle. Thus, the need for a visual check of lights is eliminated, and it will be appreciated that all or several of such lights may not be visible from the vehicle control position, so that a visual check would be inconvenient, if not hazardous in itself.

Any such indicating device is only reliable if its own operative condition is checked, and my invention provides a means for automatically testing each visual indicator for each monitored light in the system every time the lighting system is initially energized.

The invention, in addition to the foregoing advantages, provides tell-tale lamps as the visual indicating means which separately and individually monitor each light in the system. The tell-tale lamp burns uninterruptedly only when the light it monitors burns out, and consequently the indicator device is itself maintained in operative condition over very extended periods without lamp replacement.

The indicator device may be made in conveniently compact form for installation in any selected location, preferably visible from the vehicle controls position. It may be readily wired into the existing lighting system for the vehicle with only a slight change in circuitry and without any extensive rewiring.

In general, the indicator device of the invention comprises in combination with a multiple lamp lighting system, a plurality of paired first and second parallel circuits, the first circuits each including a heater element series connected to a monitored running light lamp, the second circuits each including a normally closed thermal switch and an indicator lamp remote from the running light it monitors and series connected with the switch contact. The heater element in each first circuit is positioned in operative relation to the switch in the second circuit paired therewith so that upon heating, it will open the switch. A voltage source is provided for energizing the first and second circuits whereby with the thermal switches closed the indicator or tell-tale lamps in the second circuits are illuminated upon initially energizing the circuits. This serves as an automatic check of the condition of each indicator lamp. Thereafter, if all monitored lamps are operating, current through said heater elements opens the second circuits by operation of the thermal switches and

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the indicator lights are extinguished. The indicator lights thereafter remain inoperative, i.e., unlighted until a monitored lamp in a first circuit burns out. This causes the heater element in that particular monitored lamp circuit to cool through lack of current flow, and allows the corresponding thermal switch to close energizing the paired second circuit and illuminating the indicator light. Thus, the particular lamp failure is visibly indicated at a point remote from the lamp. The indicator light remains on until the burned out lamp is replaced, or until the indicating circuits are deenergized.

These and other advantages of my invention are set forth in the following more detailed description given in conjunction with the accompanying drawings which illustrate one complete embodiment thereof. For simplicity, an indicator device for the running lights of a power boat is the embodiment selected for illustration. This is not to be construed as a limitation on the invention, which has a wide range of applications.

FIGURE 1 is a schematic wiring diagram showing a running light system for boats with the visual indicating circuit means for monitoring the condition of the lamps in the running light circuits;

FIGURE 2 is a schematic diagram of a thermal switch used in the indicator device;

FIGURE 3 is a schematic wiring diagram showing an alternative indicator device circuit for larger lighting systems operating on higher voltages, e.g. 110 or 220 volts; and

FIGURE 4 is a schematic of the indicator device mounted in a housing for installation in a selected position remote from the monitored running lights.

Referring now to FIGURE 1, there is shown a circuit diagram of a lighting system for power boats carrying bow, stern, starboard and port running lights and equipped with the indicator device of the invention. A voltage source 1 which may be a 6 or 12 volt battery for the boat's electrical system is connected through one of its terminals to contact 2 of running light switch 3. The other contact 4 of switch 3 is connected through the power-on indicator light 5 to the other terminal of the battery through ground to complete this circuit. The power-on indicator lamp 5 burns at all times that the running light switch is closed and acts as a tell-tale lamp indicating that the running light system is energized. It is a preferable part of the indicating device, but is not essential for the running light monitoring function of the indicator device.

A plurality of "first" or running light circuits are connected to contact 4 of switch 3. Each of the four circuits consists of a heater element 6, 6a, 6b and 6c connected to contact 4 of switch 3 and in series with the filament of a running light lamp 7, 7a, 7b and 7c, respectively, the circuits being completed by connection of the running lights to the other terminal of the battery through ground.

A plurality of "second" indicator circuits for the indicator lights are paired in parallel with the "first" running light circuits so that each running light lamp 7, 7a, 7b and 7c has an associated indicator light. Each of the four "second" circuits includes a normally closed thermal responsive switch 8, 8a, 8b and 8c, each of which comprises bimetal strips 10, 10a, 10b and 10c, respectively, and contacts 11, 11a, 11b and 11c, respectively. The bimetal strips are connected to contact 4 of switch 3. The contacts 11, 11a, 11b and 11c are series connected to indicator lamps 12, 12a, 12b and 12c, respectively, which are preferably low voltage lamps having a very long life. These indicator light circuits are completed by connection of the indicator lamp filaments with the other battery terminal through ground. The heater elements are preferably filament-type heater coils, but may be low ohmic resistances. Each heater is disposed in operative or heat

transfer relation to the thermal switch it controls, for example, heater 6 is proximate to bimetal member 10 of switch 8, and so on as shown in the wiring diagram of FIGURE 1.

The bimetal members of the thermal switches are preferably two joined strips of metals having different temperature coefficients of expansion, so that when heated by the heater elements, the bimetal strip curves away from its normally closed position with its associated contact and opens the indicator light or "second" circuit. The contact member of the switch may also be a bimetallic strip for insuring the switch will remain closed under ambient temperature changes. However, the switch functionally remains only a single temperature responsive bimetal unit.

FIGURE 2 shows a circuit diagram for one form of thermal responsive switch suitable for use in the invention. Bimetal strip 20 is positioned in heat-receiving position relative to filament heater coil 21. Contact 22 engages bimetal strip 20 to maintain the switch in normally closed position. Condenser 23 is shunted across the switch between the terminals 24 of the bimetal and 25 of the contact 22. Coil 21 is provided with connector tips 26 and 27 for easy connection into the monitored light circuit.

Referring again to FIGURE 1, the operation of the indicator device will be apparent from the following description. When power-on switch 3 is closed the power-on indicator lamp 5 is energized and remains on until the power-on switch is opened. All of the indicator lamps 12, 12a, 12b and 12c go on, since the thermal switches 8, 8a, 8b and 8c are normally closed and the indicator light circuits are energized. This provides an automatic self-checking feature for the indicator circuits, since an inoperative indicator lamp is immediately detected. The running light circuits are also energized and all operative running light lamps are lighted and current is drawn through the heater elements in series with the running light lamps. After a short period of time, this causes the thermal switches of the associated indicator light circuits to open, and the indicator lights go off. If a running light is inoperative, the particular running light circuit remains open, and the heater element does not heat the bimetal of the thermal switch of the associated indicator light circuit. Therefore, the indicator light remains on until the burned out running light is replaced. At any time a running light burns out, while the running light circuits are energized, the heater element in that circuit will cool and allow the thermal switch of the associated indicator light circuit to close which will cause the indicator lamp to burn and provide an immediate visual signal indicating which particular running light is not operating. As stated above, the indicating device is self-checking, since the indicator lights are all energized when the power-on switch is initially closed, and may be checked at that time for their operative or inoperative condition.

In FIGURE 3 is shown a circuit diagram adapting the indicator device to higher voltage circuits used on ships, such as 110 and 220 volt electrical systems. Only one running light circuit and one associated indicator light circuit are shown for simplicity, the arrangement of the balance of the circuits for a multiple lamp lighting system being the same as in the lower voltage embodiment shown in FIGURE 1. One terminal of the 110 volt power source 40 is connected through main switch 41 to a 110 volt lamp 42. Heater element 43 is series connected to lamp 42, but is shunted across a non-inductive low ohmic resistor 44. The value of resistance 44 is selected to produce only a low voltage drop, e.g., 0.2 volt, and thereby will not appreciably change the illumination of lamp 42. The resistor may, if desired be variable instead of fixed. This small voltage is impressed across heater element 43, which with the series current drawn by lamp 42 heats the heater element 43 sufficiently to open thermal switch 45, while not exceeding the wattage rating

of the heater coil. The lamp circuit is completed by connection of heater element 43 and resistor to the other terminal of voltage source 40. The thermal switch 45 is connected to the low voltage secondary of step-down transformer 46, the primary of which is connected to power source 40. The contact 47 of switch 45 is series connected to indicator lamp 48, which is also connected to the other terminal of voltage source 40 to complete the indicator light circuit. This circuitry is repeated for the required number of lights in the multiple lamp lighting system operating at generated voltages of 110 and 220 volts for larger ships or even for building lighting systems.

Referring to FIGURE 4, a perspective view of a box housing 30 for the indicator device of FIGURE 1 is shown. The indicator or pilot lights for the various boat running lights are shown with identification of the lights at 12 (bow), 12c (stern), 12a (port), and 12b (starboard). The power-on indicator light is shown at 5. The entire indicator device is contained within the housing, that is all heater elements and thermal switches and the wiring for the circuits. The multi-wire cord 36 is used to connect the indicator device most conveniently to the terminals of the main or power-on switch of the multiple lamp lighting system so that the heater elements are series connected to the running lights and the indicator light circuits are connected in parallel with the running light circuits.

My device is accordingly a compact unit adapted to be readily connected to an existing lighting system without any extensive wiring or rewiring. It is conveniently located or mounted so as to be visible from the control position of the vehicle or from any other more desirable location. In particular the device requires no additional wiring at the various positions of the lamps which are monitored in the existing lighting system.

What I claim is:

1. A device for separately and independently indicating the condition of each lamp in a multiple parallel lamp lighting system, which comprises in combination with said lighting system a plurality of paired first and second parallel circuits, each said first circuit including a monitored illuminating lamp and an electrical heater element series connected with said illuminating lamp but physically remote therefrom, each said second circuit including a normally closed thermal switch and an indicator lamp series connected to the switch contact, the heater element in each first circuit being positioned in operative heat transfer relation to the thermal switch in the respective second circuit paired therewith, said switch being openable by heat generated from current flow through said heater element, and a voltage source for energizing the first and second circuits whereby the indicator lamps are initially illuminated while the thermal switches are closed and the indicating circuits are thereby self-checking, and thereafter the heater elements in operative illuminating lamp circuits open the thermal switches and the monitoring indicator lamps are extinguished and each remains unlighted until a monitored illuminating lamp burns out in which case the thermal switch again closes and the associated indicator lamp goes on to indicate the inoperative condition of the particular monitored lamp.

2. A device as claimed in claim 1 adapted for use with house current voltages in which the heater element in the monitored lamp circuits is shunted across a low ohmic resistor, and the power source is connected to the indicator lamp circuits through a voltage reducing transformer.

3. An indicator device for electrical connection to multiple lamp parallel lighting circuit systems for monitoring separately the condition of each illuminating lamp therein at a common location remote from the lamps, which comprises a plurality of heater elements, one each adapted for series connection to each illuminating lamp of said system and being operative as a heater at a voltage no greater than that of the illuminating lamp circuit, and

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a plurality of indicator lamps, one for each monitored illuminating lamp in said lighting system, each of said indicator lamps being series connected to a normally closed thermal switch positioned in operative heat transfer relation to one of said heater elements, said switch being openable by heat generated from current flow through said heater element, the indicator lamp and switch circuits being adapted for parallel connection to said monitored lamp circuits, and the device when so connected illuminating the indicator lamps when the circuits are initially energized, and, thereafter, the heater elements in operative illuminating lamp circuits opening the thermal switches, the associated indicator lamps being extinguished, and when a particular monitored lamp in said multiple system is burned out, the series connected heater element cools, and the associated thermal switch closes to illuminate the indicator lamp.

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