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[54] **VISUAL AND RF BEACON FOR MINER'S HAT WITH CONTROL CIRCUIT**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.** **H04b 1/04**

[58] **Field of Search** 340/249, 332; 320/48; 325/111, 118, 113, 119, 186, 185, 105

[56] **References Cited**

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[57] **ABSTRACT**

A lamp and a radio transmitter are connected in parallel across a battery in a miner's hat to provide a visual and radio-frequency beacon enabling finding him in an emergency situation. In order to prevent the lamp from depleting the battery which would cut off the radio beacon, an involuntarily opened nonresettable switch is provided that disconnects the battery from everything but the transmitter. A voltage detector connected across the lamp senses when the voltage applied to this lamp drops below a predetermined level and closes a circuit to pass current through an electrically actuatable element for opening the switch. This element can be a minute squib or a fuse-type device forming the switch itself.

8 Claims, 3 Drawing Figures

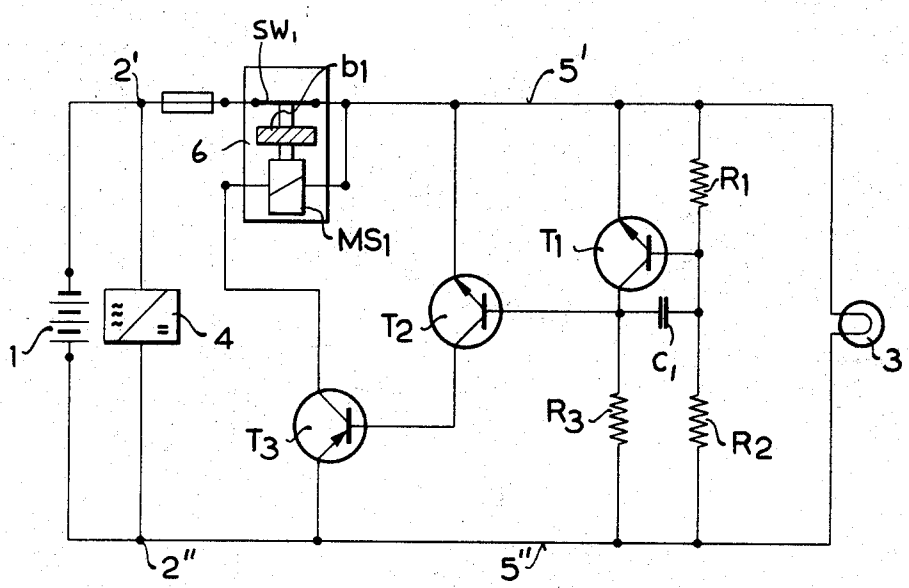


FIG.1

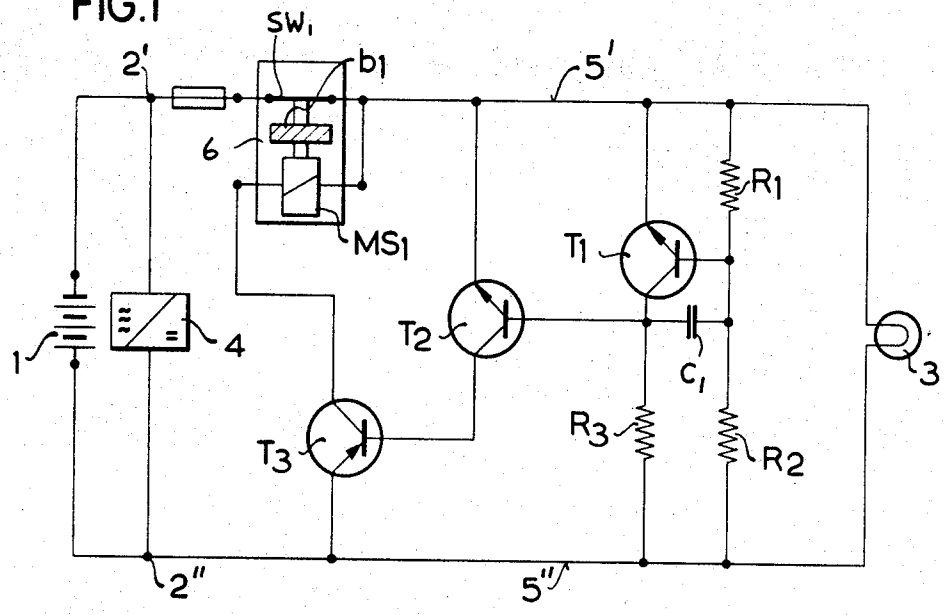
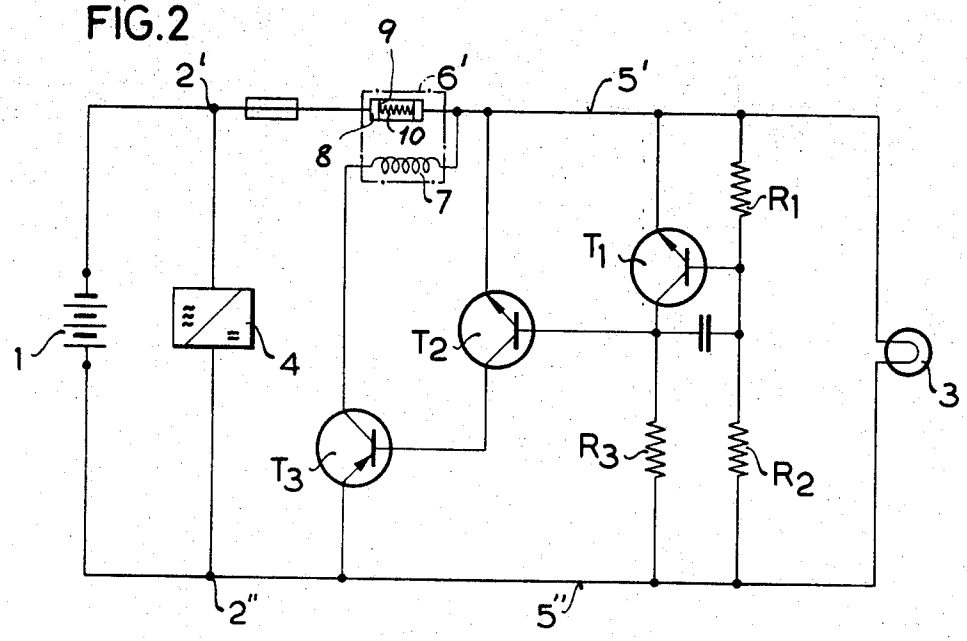


FIG.2



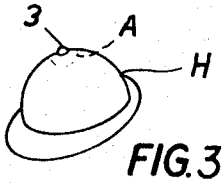


FIG.3

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VISUAL AND RF BEACON FOR MINER'S HAT WITH CONTROL CIRCUIT

1. FIELD OF THE INVENTION

The present invention relates to an electrical warning apparatus. More particularly this invention concerns such an apparatus which includes an RF transmitter and a signal lamp intended to be mounted in a miner's hat or the like.

2. BACKGROUND OF THE INVENTION

In order to be able to locate a miner in an emergency his hat may be equipped with a small beacon light or a headlamp and a radio-frequency transmitter to allow a searcher to find him even if the miner is unconscious. Since this device must be entirely mounted in the miner's hardhat, it is important that it be small and difficult to damage. A similar device can be used in life vests for boaters, pilots, and the like.

It has been found that the relatively high-drain lamp may deplete the batteries, thereby making the low-drain beacon transmitter ineffective. It is desirable to maintain the useful life of the transmitter even when the lamp is extinquished, since this transmitter is ultimately the most effective means for locating a person in emergency conditions. Circuits have been proposed using relays and the like which shut off the lamp after the battery voltage drops below a predetermined threshold while continuing to let the beacon transmitter function. All such circuits have been complicated or have possessed such a substantial current drain by themselves that they shorten the service life of the battery considerably, thus defeating their principal purpose.

3. OBJECTS OF THE INVENTION

It is therefore an object of the present invention to provide an improved electrical warning apparatus adapted for use in a miner's hat, a life vest, or the like.

Another object is the provision of such an apparatus which overcome the above given disadvantages.

Yet another object is to provide such an electrical warning beacon wherein the circuit used to shut off the light consumes very little current and which after shutting off the light consumes none at all.

4. SUMMARY OF THE INVENTION

The above objects are attained according to the present invention by an apparatus wherein the beacon transmitter and beacon lamp are connectable in parallel across the poles of a battery. A detector circuit is connected to the battery in order to sense a drop in the battery voltage below a predetermined level. A switching circuit including an electrically energizable element of low resistivity is connected to the detector to "blow" or permanently open-circuit the element when the voltage drops below the predetermined level and cut off power to the lamp and all circuitry save the transmitter.

This arrangement according to the present invention offers only 2 mohm, at most, of additional resistance to the circuit of the lamp. Once the current path is interruped by the fusible or mechanically rupturable element to cut off this lamp there is no more power consumption by anything other than the transmitter. Thus the unit is characterized by low power consumption prior to cutoff and virtually none thereafter. In other words, the transmitter is connected directly across the battery while the lamp, in parallel therewith, is connected at a location separated from the junction between the transmitter and the battery by a high conductivity rupturable element. The sensing circuit includes a voltage detector connected across the battery in series with the rupturable element as well and can activate the latter while being deenergized upon electrical rupture of the element.

The switch according to this invention can be a so-called electrical microtemperature fuse having a small heating coil which when, activated, quickly melts a small mass of fusible metal so that a spring pulls a pair of contacts apart and interrupts the current path. Alternatively a switch having a minute squib or the like can be provided such that, when this element is electrically activated, it actually blows out the connection to form an open circuit. In either case, breakdown of the nonresettable element does not depend, as in an ordinary fuse or circuit breaker, on a flow of current therethrough in series with the lamp.

5. DESCRIPTION OF THE DRAWING

The above and other objects, features, and advantages will become apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a schematic diagram of a first embodiment of the present invention;

FIG. 2 is a schematic diagram of a second embodiment of this invention, and

FIG. 3 shows a miner's hat provided with the device according to the present invention.

6. SPECIFIC DESCRIPTION

As seen in FIG. 1 a battery 1 has a negative terminal 2' and a positive terminal 2'' across which are connected in parallel a small incandescent lamp 3 and a small beacon transmitter 4. A conductor 5' leads from the pole 2' to one side of the lamp 3 and a conductor 5'' from the other pole 2'' to the other side of the lamp.

A pair of resistors R_1 and R_2 are connected in series across the two conductors 5' and 5'' and act as a voltage divider for a high-gain transistor T_1 whose base is coupled to the junction between these resistors. The emitter of transistor T_1 is coupled to the junction between these resistors. The emitter of transistor T_1 is coupled directly to the negative conductor 5' and the collector is connected through a bias resistor R_3 to the positive conductor 5'', with a capcitor C_1 bridging the base and collector. This transistor T_1 and the resistors R_1 and R_2 are so chosen that when the voltage output of the battery 1 measured between the conductors 5' and 5'' drops to 1.8 Volts the transistor T_1 ceases to conduct.

Connected to the collector of transistor T_1 is the base of a driver transistor T_2 whose emitter is connected to line 5' and whose collector feeds directly into the base of a transistor T_3; the emitter of the latter is connected to the line 5'' and its collector is connected through a switch unit 6 to the conductor 5'. Inside the switch device 6 is an igniting element MS_1 which when electrically stimulated sets off a tiny squib b_1 which opens a switch SW_1 connected in the conductor 5'. This switch SW_1 is disposed between all of the ciruitry described with the exception of the transmitter 4 and the battery 1, so that when it is open this transmitter 4 alone remains connected across the battery.

Thus when the voltage across the voltage divider R_1, R_2 drops below 1.8 volts the transistor T_1 stops conducting thereby switching on the two transistors T_2 and T_3 to send a pulse through the element MS_1. With a current of 0.55 amperes after 15 to 25 milliseconds this element MS_1 blows, opening the current path to the lamp 3 and all three transistors T_{1-3}.

The same circuitry is used in FIG. 2 except that a micro temperature fuse 6' having a heating coil 7 is used. A pair of contacts 8 and 9 are provided one of which is made of an easily meltable metal and which are pulled apart by a spring 10 when the coil 7 has heated the fusible contact sufficiently to soften it. In all other respects this arrangement functions identically to that of FIG. 1.

FIG. 3 shows the apparatus A mounted in the crown of a miner's hardhat H.

We claim:

1. An electrical warning apparatus comprising:

a battery;

transmitter means connected across said battery and in circuit therewith for emitting a radio signal;

a lamp connected across said battery and illuminable thereby;

voltage-detector means connected to said battery for detecting a drop in voltage output thereof below a predetermined threshold level; and

switch means including a rupturable element in series with said lamp across said battery and external of the circuit between said transmitter means, said voltage-detector means being connected to said switch means for rupturing said element to open the circuit to said lamp and extinguish same upon said voltage output of said battery dropping below said predetermined threshold level, while permitting said transmitter means to remain connected to said battery.

2. The apparatus defined in claim 1 wherein said voltage-detector and switch means present a resistance of at most 2 milliohms in series with said battery.

3. The apparatus defined in claim 1 wherein the switch means includes an electrically actuatable element connected to said voltage-detector means and operable to permanently break said rupturable element, said voltage-detector means being connected across said battery in series with said rupturable element.

4. The apparatus defined in claim 3 wherein said rupturable element includes a pair of contacts fused together and a spring biasing said contacts apart, said electrically actuatable element including a heater energized by an electric current and being connected electrically to said voltage-detector means for heating said contacts and enabling said contacts to pull apart.

5. The apparatus defined in claim 3 wherein said electrically actuatable element is a squib disposed adjacent said rupturable element.

6. The apparatus defined in claim 3 wherein said voltage-detector means includes a voltage-divider network connected across said lamp and at least one transistor connected to said network and to said electrically actuatable element.

7. The apparatus defined in claim 6 wherein said voltage-detector means includes a first transistor connected to said network as a sensor and at least one second transistor connected between said element and said electrically actuatable first transistor.

8. The apparatus defined in claim 7 wherein said voltage-detector means includes two such second transistors directly coupled with one another, one of said second transistors being connected to said first transistor and the other of said second transistors to said electrically actuatable element.

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