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Kearsley

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[54] **DAY-NIGHT FLASH BEACON**

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[52] **U.S. Cl.** **340/105,** 315/159, 315/241

[51] **Int. Cl.** **H05b 41/32**

[58] **Field of Search** ..... 340/25, 28, 50, 77, 81 R, 340/105, 343, 344; 315/149, 152–154, 156–159, 238, 240, 209 CD, 227 R, 241 R, 241 P, 241 S; 240/1.2, 11.4

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Primary Examiner—Donald J. Yusko

[57] **ABSTRACT**

A flash beacon in which the same bulb is operated in two different modes by a single power supply. A first discharge capacitance operates the lamp in a single flash mode and a second smaller discharge capacitance operates the lamp in a multiple discharge mode with the smaller discharge capacitance being recharged by the first discharge capacitance. A light sensitive relay operates to switch the beacon from a single flash mode in day time to a multiple flash mode at night.

5 Claims, 2 Drawing Figures

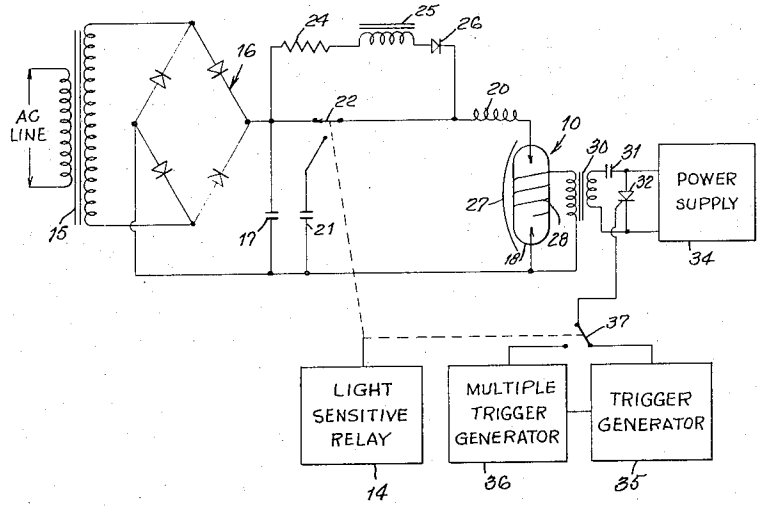


Fig. 1.

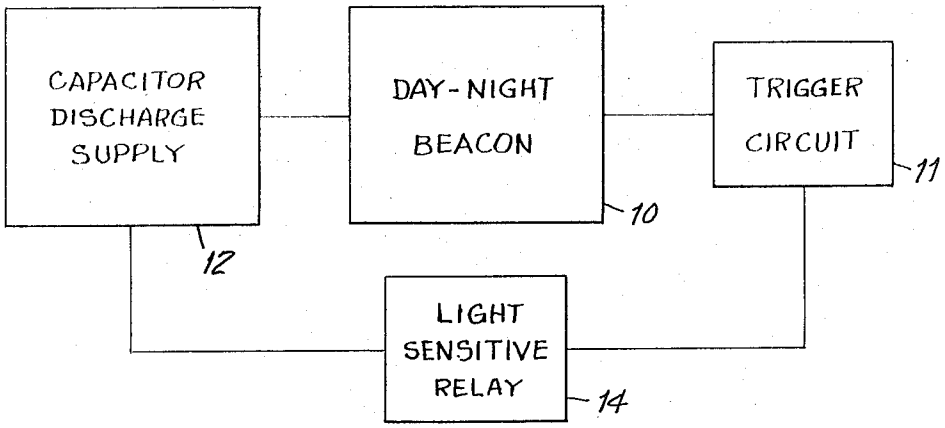
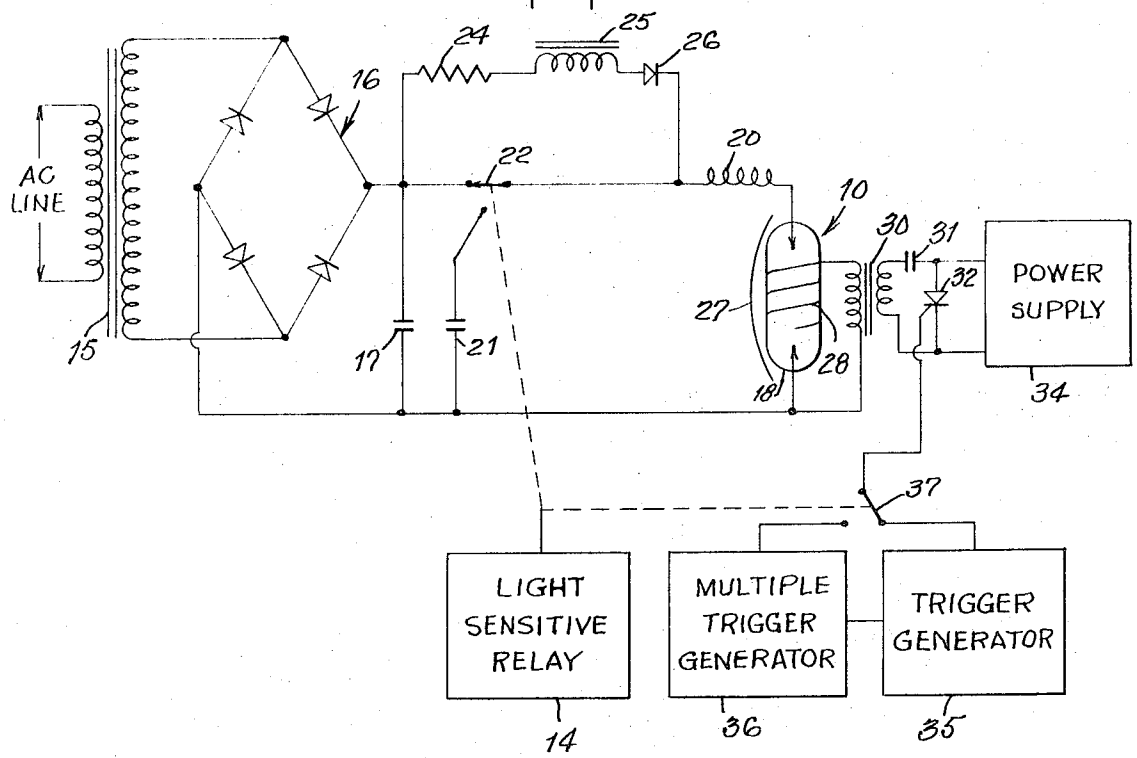

CAPACITOR DISCHARGE SUPPLY
DAY-NIGHT BEACON
TRIGGER CIRCUIT
LIGHT SENSITIVE RELAY
12
10
11
14

Fig. 2


AC LINE
15
16
17
21
22
24
25
26
20
10
27
28
18
30
31
32
POWER SUPPLY
34
37
LIGHT SENSITIVE RELAY
14
MULTIPLE TRIGGER GENERATOR
36
TRIGGER GENERATOR
35

DAY-NIGHT FLASH BEACON

BACKGROUND OF THE INVENTION:

1. Field of the Invention:

The present invention relates to flash type beacon lights and particularly those used as tall structure warning signals for aircraft.

2. Description of the Prior Art:

Warning lights on tall structures, in the past, usually have been red lights both flashing and continuous, used only at night. With the increasing speeds of aircraft and the greater height of present structures, it has become necessary to use warning lights for all conditions of visibility — day, night and fog. For effective use in the daytime high intensity xenon flash beacons are coming into extensive use.

The intensity of these beacons is useful also to pierce fog for a considerable range. However, the high intensity beacons are too intense for satisfactory use at night. Not only are they a cause of complaint for people on the ground, in nearby buildings and in cars, but they are also uncomfortable for aircraft pilots. The flashes are so intense as to saturate vision and are so short in duration that their location is hard to pinpoint. Accordingly, flash beacons for daytime use have been unsuitable for night use and separate night systems are conventional.

My U.S. Pat. No. 3,737,645 describes a flash beacon with unusually low output below the beam axis so as to reduce annoyance to people on the ground. However, the single high intensity flashes still reflect from other tall structures in the vicinity and have the deficiencies already mentioned with respect to aircraft pilots.

It is readily possible to switch the discharge supply of a flash system to smaller voltage to lower the output. However, if the voltage is lowered, the flashtube efficiency is lower and it is more likely to misfire. If the capacity is switched to a smaller value with the same voltage, the flash duration is short and particularly difficult to pinpoint. For a given intensity, shorter flashes have also been shown to be more annoying.

Modulated or flickering flashes have been used in the past as described for example in U.S. Pat. No. 3,046,448. However, devices such as these have not been used for multiple mode operation.

SUMMARY OF THE INVENTION:

In accordance with the present invention, a day-night mode beacom system is provided using a capacitive discharge system to operate high intensity flashtubes. In daytime use, a large capacitor or battery of capacitors provides high power single flash discharges to the flashtube. At night, a light sensitive relay switches the flashtube across a smaller capacitor or battery of capacitors which is charged from the first capacitor. The charging rate of the second capacitor being controlled to provide discharges at a rate of between **20** and **120** per second in groups. The light sensitive relay also switches a trigger generating circuit to provide single or group triggers in accordance with the flash mode.

Thus, it is an object of the invention to provide a flash beacon that provides single high intensity flashes in daylight and multiple flashes of lower power at nighttime.

It is a further object of the invention to provide a single aircraft warning beacon suitable for use in both daylight and night conditions.

It is a further object of the invention to provide a capacitive discharge system selectively delivering relatively high power single discharges and relatively low power multiple discharges.

Further objects and features of the invention will be better understood upon reading the following description together with the drawing.

BRIEF DESCRIPTION OF THE DRAWING:

FIG. **1** is a block diagram of a day-night beacon system according to the invention.

FIG. **2** is a schematic diagram partially in block of the beacon system of FIG. **1.**

DESCRIPTION OF THE PREFERRED EMBODIMENT:

Flash beacons today conventionally include a flash discharge lamp such as a xenon flashlamp, a capacitive discharge power supply and a trigger circuit to provide a high voltage ionization pulse for triggering the discharge through the flashtube.

In a preferred embodiment of the present invention a day-night beacon **10** is suitably a xenon flashlamp in a reflector such as described in my U.S. Pat. No. 3,737,645.

Dual-mode trigger circuit **11** provides high voltage ionization pulses to the flashlamp in beacon **10** and dual-mode capacitive discharge supply **12** provides high current discharges to the flashlamp each time it is ionized by trigger circuit **11.**

For use in daylight trigger circuit **11** preferably provides trigger pulses at a rate of between 30 and 60 pulses a minute. For use of the inventive beacon for marine purposes slower trigger rates could be used. However, at the high speeds of modern aircraft it is necessary to give the warning flashes in fairly close repetition.

Light sensitive switch **14** is connected to switch both trigger circuit **11** and capacitive discharge **12.** As dark approaches, light sensitive switch **14** switches operating further relays or gates in circuit **11** and supply **12.** The relays or gates in trigger circuit **11** switch the trigger circuit to supply groups of trigger pulses in which each group contains pulses at the rate of 15 to 120 pulses per second and the groups are provided at the same rate as the single daylight flashes. The duration of each group is preferably in the range of 0.1 to 0.5 seconds. Shorter groups make it difficult for airplane pilots to pinpoint the flash source and longer groups are unnecessary and thus inefficient. The relay in supply **12** switches the discharge capacitor to a smaller capacity.

In FIG. **2** a simplified schematic of capacitive discharge supply **12** is given along with day-night beacon **10,** depicted diagrammatically, and trigger circuit **11** depicted in more detailed block form.

Capacitive discharge supply **12** is conventional for purposes of the single flashes. Thus, it comprises a high voltage transformer **15** followed by a fullwave bridge rectifier **16** charging a capacitor **17.** Capacitor **17** is connected across flashtube **18** of beacon **10** through coil **20.** Coil **20** determines the shape and duration of the discharge pulse through tube **18.**

For night use, second smaller capacitor **21** is connected across flashtube **18** by relay contact **22** with is

in series between capacitor **17** and coil **20.** Capacitor **17** has preferably at least five times the capacity of capacitor **21.** Thus, when relay contact **22** switches, capacitor **17** is disconnected from coil **20** and capacitor **21** is connected. Bypassing relay contact **22** and connecting capacitor **17** to coil **20** is a series combination of resistor **24,** choke **25** and rectifier **26.** This series connection provides a charging path to capacitor **21** when contact **22** is in the nighttime position.

Choke **25** has the main purpose of preventing sufficient current from capacitor **17** passing through the charging path of capacitor **21** to maintain flashtube **18** ionized. It has a secondary effect of permitting the voltage on capacitor **21** to exceed the voltage on capacitor **17.** However, since this voltage could reach close to double that of capacitor **17,** resistor **24** operates to limit the voltage on capacitor **21.**

Rectifier **26** blocks reverse current thus preventing any undesirable oscillation. Day-night beacon **10** is depicted as having a reflector **27** and as having a trigger wire **28** encircling lamp **18** for ionizing trigger pulses. Trigger circuit **11** is depicted as having a pulse transformer **30** with its secondary connected to trigger wire **28** and its primary connected to capacitor **31,** SCR (silicon control rectifier) **32** and a power supply **34.**

This part of the trigger circuit is conventional with power supply **34** charging capacitor **31** which is then discharged through the primary of transformer **30** by triggering SCR **32** into conduction. The triggers for SCR **32** are provided by trigger generator **35** and multiple trigger generator **36.**

Relay contact **37** connected from the gate of SCR **32** is operated by the switch in light sensitive switch **14.** In daytime operation relay contact **37** connects the gate of SCR **32** to trigger generator **35.** Trigger generator **35** is suitably a multivibrator having the frequency of the daytime flashing rate.

For nighttime operation relay **37** switches to connect generator **36** to the gate of SCR **32.** Multiple trigger generator **36** as depicted is actuated by triggers from trigger generator **35.**

While many conventional circuits are suitable, generator **36** may conveniently be a monostable multivibrator which switches for a predetermined interval of time upon each trigger from generator **35** and then switches back. During the on-time of the monostable multivibrator, its output would provide an enable voltage to a free running multivibrator providing triggers to SCR **32.**

Trigger circuit **11** can also be made using many alternative gating, counting or oscillating circuits other than those described for generators **35** and **36.** It will also be recognized that generators **35** and **36** can be simple digital circuits and that relay contact **37** can be digital gates controlled by relay **14.**

While the invention has been described with relation to a specific embodiment, various alternative arrangements will be obvious to those skilled in the art without departing from the contemplation of the invention and it is intended to cover the invention in accordance with the breadth and scope of the following claims.

I claim:

1. A flash beacon for providing high power daytime flashes and relatively lower power nighttime flashes comprising:

a. A dual-mode capacitive discharge power supply having selectable large and small discharge capacities;

b. A gaseous discharge flashlamp connected to said power supply;

c. A dual-mode trigger circuit having selectable single repetitive trigger generator and group repetitive trigger generator connected to said flashlamp for providing ionizing trigger pulses; and,

d. An automatic switch connected to said dual-mode capacitive discharge power supply and said dual-mode trigger circuit for operating to select said small discharge capacity and said group repetitive trigger generator at night.

2. A flash beacon according to claim **1** wherein said automatic switch is a light sensitive switch.

3. A flash beacon according to claim **1** wherein said group repetitive trigger generator generates group pulses at a repetition rate within each group in the range of 15 to 120 pulses per second.

4. A flash beacon according to claim **1** wherein said small discharge capacity is charged by said large discharge capacity through an inductance.

5. A capacitive discharge circuit for driving a flash lamp comprising:

a. A single high voltage DC power supply having first and second output terminals;

b. A first capacitor of a predetermined cpacity having first and second electrodes connected to said first and second output terminals respectively;

c. A second capacitor of substantially less capacity than said first capacitor having a first electrode connected to said first terminal and a second electrode;

d. A flash lamp having a first electrode connected to said first terminal and a second lamp electrode;

e. Switchable contacts for connecting said second lamp electrode to the second electrode of an alternative one of said first and second capacitors and actuated by a light sensitive relay connected for activating said contacts to connect the electrodes of said second capacitor across said flash lamp when the ambient light falls below a preset level;

f. a charging circuit for said second capacitor comprising an inductor connected between the second electrodes of said first capacitor and said second capacitor across said switchable contacts; and,

g. A trigger circuit coupled to said flash lamp for triggering discharge of a connected one of said first and second capacitors through said flash lamp.

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