

PATENT SPECIFICATION

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(54) ELECTRONIC FLASH UNITS

(71) We, PONDER & BEST, INC., a corporation organized under the laws of the State of California, United States of America, of 1630 Stewart Street, Santa Monica, California, 90406, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be described in and by the following statements:—

This invention relates to electronic flash units normally associated with the photographic arts.

Electronic flash units typically include a flash device such as a xenon discharge tube, a storage means such as a storage capacitor connected across the discharge tube and triggering circuitry to fire the discharge tube. Once the discharge tube is fired, the storage capacitor is discharged and a recycle time must expire before the storage capacitor is again at a sufficient potential for a subsequent firing of the discharge tube. The user of the electronic flash unit, usually a camera operator, must be alerted that a proper recycle time has expired to allow the flash unit to be in a "ready" state.

In the past, visual alert signals have been utilized to alert the camera operator that the electronic flash unit is capable of producing a flash. Visual alert signals usually employ a neon bulb which is activated when the storage capacitor is at a sufficient potential for the firing of a discharge tube. A visual alert signal is typically difficult to observe in that the camera operator must search for this visual signal by taking his eyes off the camera and camera view finder in order to scan the companion electronic flash unit for a visual indication.

Visual alert signals create a further problem in that the camera operator is likely to be in a variety of lighting conditions and, as such, the condition of the visual signal or bulb may not be readily apparent.

The foregoing problems have been substantially eliminated by providing an electronic flash unit comprising: a flash device; storage means for applying a voltage

to said flash device to cause said flash device to fire when triggered; circuit means for triggering said flash device to allow discharge of said storage means into said flash device; and means for producing an audible alert signal when said storage means is at a voltage level sufficient to cause said flash device to fire when triggered.

The audible alert signal, which is preferably of a limited duration, serves to alert the camera operator that the associated flash unit is in a "ready" state. This audible alert signal allows the camera operator to give full visual attention to the camera and camera view finder and can enable a lessening of the number of pictures taken when the flash unit is not in the "ready" state.

The means for producing an audible alert signal may comprise an audio oscillator or a buzzer. The unit may also include means for producing a visual alert signal in conjunction with the audible alert signal.

The invention, both as to its organization and principle of operation, together with further advantages thereof, may better be understood by reference to the following detailed description of an embodiment of the invention given by way of example and with reference to the accompanying drawing.

The drawing is a circuit diagram illustrating an embodiment of the basic concepts of a flash unit including means for producing an audible alert signal, comprising an audio oscillator, in conjunction with a visual alert signal in the form of a neon bulb.

Referring now to the drawing, there is shown a flash unit 11 enclosed in dotted lines which includes a flash device of xenon discharge tube 12 with principal electrodes 13 and 14 included therein. Principal electrode 13 is connected to an upper conductor 15 and principal electrode 14 is connected to a lower conductor 16. The flash unit 11 receives its energization from any suitable source of potential (not shown) connected to terminals 17 and 18 of conductors 15 and 16 respectively.

As is well known in the art, triggering circuitry for a flash unit includes a step up triggering coil or transformer 19 having a primary coil 29 and a secondary coil 21 to trigger the discharge tube 12 through a trigger electrode 22 when required. The trigger electrode 22 may be either within or outside of the discharge tube 12. Resistor 23 is connected between upper conductor 15 and capacitor 24. Capacitor 24 is connected at its other end to lower conductor 16. Transformer 19, resistor 23 and capacitor 24 comprise triggering circuitry normally used in flash units.

Primary coil 20 of transformer 19 receives its excitation when a normally open switch 25, which is responsive to a shutter switch of an associated camera, is closed. This allows capacitor 24 to discharge across primary winding 20 thereby activating transformer 19 and trigger electrode 22 which triggers discharge tube 12.

Connected across discharge tube 12 is a main storage capacitor 26 which will receive its energization from the source (not shown) applied at terminals 17 and 18. Capacitor 26, when fully charged, will not "fire" discharge tube 12, but will apply a voltage to the discharge tube 12 equal to its charged value. The voltage from the charged capacitor 26 and the triggering of the discharge tube 12 through trigger electrode 22, when switch 25 is closed, causes the discharge tube 12 to fire.

In order to provide in this embodiment the addition of a visual alert signal, resistor 27 and a visual alert signal means, such as a gas tube or a neon bulb 28, are serially connected in upper conductor 15 between one end of capacitor 26 and circuitry 29, to be described later. The gas in neon bulb 28 prevents current from travelling to an audible signal means, such as a buzzer, or circuitry 29 until an ignition voltage level or firing voltage is achieved across neon bulb 28. Once this firing voltage is achieved, the gas in neon bulb 28 ionizes or ignites and illuminates thereby providing a visual indication.

The firing voltage of neon bulb 28 is reached when storage capacitor 26 reaches a voltage level capable of firing discharge tube 12 when triggered by the voltage applied to trigger electrode 22.

In order to provide an audible alert signal when storage capacitor 26 is capable of providing its required voltage to discharge tube 12, audible signal means or circuitry 29 is provided. The conducting neon bulb 28 establishes a voltage at a point "A" between the neon bulb 28 in flash unit 11 and capacitor 30. In circuitry 29, capacitor 30 is connected between upper conductor 15a and lower conductor 16 to allow a slow rise

in the voltage established at a point "A" as capacitor 30 charges.

Neon bulb 28 is further connected to circuitry 29 through resistor 31 to the base of transistor 32. Transistor 32 is connected in a manner well known in the art to a ceramic transducer element 33 to form an audio oscillator. For illustration, transistor 32 is shown to be an NPN transistor, and an audio oscillator utilizing a PNP transistor configuration with a ceramic transducer element may be used instead. Transistor 32 and the ceramic transducer element 33 will oscillate in the audible range, and in this preferred embodiment at a value approximating 2 kHz.

As is well known in the art, the unique configuration and resonance characteristics of the ceramic transducer element 33 to allow adequate phase relationships to transistor 32 will cause audio oscillation when properly biased. Transistor 32 receives its bias voltage from a bias source (not shown) applied between terminals 34 and 35 of upper conductor 15b and lower conductor 16 respectively. This bias source is applied to the emitter of transistor 32 from terminal 35 through resistor 36 and ceramic transducer element 33. This bias source is also applied to the collector of transistor 32 through a variable resistor 37 which is varied to adjust the time duration of the audible signal.

Resistor 38 is connected between variable resistor 37 and terminal 34, and capacitor 39 is connected at one end between variable resistor 37 and resistor 38 and is connected at the other end to terminal 35 to provide isolation for circuitry 29 in a manner well known in the art.

In operation, switch 25 in flash unit 11 is normally open, and the only voltage applied to discharge tube 12 is that associated with storage capacitor 26. The voltage across the storage capacitor 26 is normally not great enough to fire tube 12 and requires switch 25 to be closed (as the shutter of the camera is closed) to allow the voltage from the triggering circuitry applied through electrode 22 to "fire" discharge tube 12. Once the discharge tube 12 is fired, the voltage across storage capacitor 26 drops drastically due to the low resistance or "short circuiting" effect of the discharge tube 12. The storage capacitor 26 is usually recharged after the discharge tube 12 has fired in order to provide sufficient voltage to "fire" the discharge tube 12 again.

The gas in neon bulb 28 will ignite and illuminate when the voltage across storage capacitor 26 reaches the ignition voltage level of the neon bulb 28.

Once the neon bulb 28 has ignited, and therefore will be conductive, capacitor 30 of

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circuitry 29 will receive the voltage established by neon bulb 28 and will establish a voltage rise slowly at point "A" due to the charging of capacitor 30 at a rate determined by resistor 27. Thus, the neon bulb 28 or other suitable gas tube (with or without a visual display) may be used to establish a source of voltage when the ionization of the tube occurs. This voltage may be used to activate an audible alert signal.

The increasing voltage appearing at point "A" is applied to the base of transistor 32 to allow transistor 32 to be biased "on" and thus oscillate and produce an audible alert signal in combination with the ceramic transducer element 33 to alert a camera operator that flash unit 11 is ready for refiring. Transistor 32 is biased in such a manner that oscillations will only occur within a narrow range of the forward voltage applied to the base of transistor 32. Voltages above or below this range will cause oscillations to cease. Since the voltage at point "A" has a rising characteristic due to the charging effect of capacitor 30, the oscillations caused by transistor 32 and the ceramic transducer element 33 are only temporary. The length of time of these oscillations which will produce the audio signal can be varied by adjusting resistor 37 connected to the collector of transistor 32.

It has been shown that by providing a circuit in the form of an audio oscillator comprising a transistor and a ceramic transducer element that an audible alert signal of a pre-determined duration can be accomplished to indicate the "ready" state of a flash unit.

While an embodiment and application of this invention has been shown and described, it will be apparent to those skilled in the art that many more modifications are possible without departing from the inventive concepts herein described.

WHAT WE CLAIM IS:—

1. An electronic flash unit comprising: a flash device; storage means for applying a voltage to said flash device to cause said flash device to fire when triggered; circuit means for triggering said flash device to allow discharge of said storage means into said flash device; and means for producing an audible alert signal when said storage means is at a voltage level sufficient to cause said flash device to fire when triggered.

2. An electronic flash unit as claimed in Claim 1, including means for terminating the audible signal after a predetermined duration.

3. An electronic flash unit as claimed in Claim 2 wherein said means for terminating the audible signal after the predetermined duration includes capacitive means for applying a voltage to said audio alert signal

means thereby terminating the audio alert signal.

4. An electronic flash unit as claimed in any one of Claims 1 to 3 wherein said means for producing an audible alert signal comprises an audio oscillator.

5. An electronic flash unit as claimed in Claim 4 wherein said audio oscillator is a single transistor ceramic transducer element audio oscillator.

6. An electronic flash unit as claimed in any one of Claims 1 to 5 wherein the audio alert signal is produced at a frequency of approximately 2 kilohertz.

7. An electronic flash unit as claimed in any one of Claims 1 to 6, including means for producing a visual signal when said storage means is at a voltage level sufficient to cause said flash device to fire when triggered.

8. An electronic flash unit as claimed in Claim 7 wherein the audible signal is produced in response to the production of the visual signal.

9. An electronic flash unit as claimed in any one of Claims 1 to 8, including a gas tube responsive to the voltage across said storage means and capable of achieving an ionization state when said storage means is at a voltage level sufficient to cause said flash device to fire when triggered, the means for producing an audible alert signal being responsive to said gas tube to produce such signal when said gas tube achieves the ionization state.

10. An electronic flash unit as claimed in Claim 9 wherein said gas tube is a neon bulb.

11. An electronic flash unit as claimed in any one of Claims 1 to 10, said audible alert signal means being controlled by a signal produced by control signal means responsive to said voltage.

12. An electronic flash unit as claimed in Claim 11 when dependent on Claim 2, said audible alert signal means being activated during a predetermined portion of the signal produced by said control signal means.

13. An electronic flash unit as claimed in Claim 11 or Claim 12, said control signal means providing a varying signal to said audible alert signal means, said audible alert signal means being activated a predetermined time delay after the varying signal is provided.

14. An electronic flash unit as claimed in Claim 13, said audible signal means being activated by a predetermined portion of the varying signal.

15. An electronic flash unit as claimed in Claim 13 or Claim 14 when dependent on Claim 8, said control signal means being electrically coupled to said visual signal means and said audible signal means for providing said varying signal to said audible

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3 circuitry 29 will receive the voltage established by neon bulb 28 and will establish a voltage rise slowly at point "A" due to the charging of capacitor 30 at a rate determined by resistor 27. Thus, the neon bulb 28 or other suitable gas tube (with or without a visual display) may be used to establish a source of voltage when the ionization of the tube occurs. This voltage may be used to activate an audible alert signal.

The increasing voltage appearing at point "A" is applied to the base of transistor 32 to allow transistor 32 to be biased "on" and thus oscillate and produce an audible alert signal in combination with the ceramic transducer element 33 to alert a camera operator that flash unit 11 is ready for refiring. Transistor 32 is biased in such a manner that oscillations will only occur within a narrow range of the forward voltage applied to the base of transistor 32. Voltages above or below this range will cause oscillations to cease. Since the voltage at point "A" has a rising characteristic due to the charging effect of capacitor 30, the oscillations caused by transistor 32 and the ceramic transducer element 33 are only temporary. The length of time of these oscillations which will produce the audio signal can be varied by adjusting resistor 37 connected to the collector of transistor 32.

It has been shown that by providing a circuit in the form of an audio oscillator comprising a transistor and a ceramic transducer element that an audible alert signal of a pre-determined duration can be accomplished to indicate the "ready" state of a flash unit.

While an embodiment and application of this invention has been shown and described, it will be apparent to those skilled in the art that many more modifications are possible without departing from the inventive concepts herein described.

WHAT WE CLAIM IS:—

1. An electronic flash unit comprising: a flash device; storage means for applying a voltage to said flash device to cause said flash device to fire when triggered; circuit means for triggering said flash device to allow discharge of said storage means into said flash device; and means for producing an audible alert signal when said storage means is at a voltage level sufficient to cause said flash device to fire when triggered.

2. An electronic flash unit as claimed in Claim 1, including means for terminating the audible signal after a predetermined duration.

3. An electronic flash unit as claimed in Claim 2 wherein said means for terminating the audible signal after the predetermined duration includes capacitive means for applying a voltage to said audio alert signal

means thereby terminating the audio alert signal.

4. An electronic flash unit as claimed in any one of Claims 1 to 3 wherein said means for producing an audible alert signal comprises an audio oscillator.

5. An electronic flash unit as claimed in Claim 4 wherein said audio oscillator is a single transistor ceramic transducer element audio oscillator.

6. An electronic flash unit as claimed in any one of Claims 1 to 5 wherein the audio alert signal is produced at a frequency of approximately 2 kilohertz.

7. An electronic flash unit as claimed in any one of Claims 1 to 6, including means for producing a visual signal when said storage means is at a voltage level sufficient to cause said flash device to fire when triggered.

8. An electronic flash unit as claimed in Claim 7 wherein the audible signal is produced in response to the production of the visual signal.

9. An electronic flash unit as claimed in any one of Claims 1 to 8, including a gas tube responsive to the voltage across said storage means and capable of achieving an ionization state when said storage means is at a voltage level sufficient to cause said flash device to fire when triggered, the means for producing an audible alert signal being responsive to said gas tube to produce such signal when said gas tube achieves the ionization state.

10. An electronic flash unit as claimed in Claim 9 wherein said gas tube is a neon bulb.

11. An electronic flash unit as claimed in any one of Claims 1 to 10, said audible alert signal means being controlled by a signal produced by control signal means responsive to said voltage.

12. An electronic flash unit as claimed in Claim 11 when dependent on Claim 2, said audible alert signal means being activated during a predetermined portion of the signal produced by said control signal means.

13. An electronic flash unit as claimed in Claim 11 or Claim 12, said control signal means providing a varying signal to said audible alert signal means, said audible alert signal means being activated a predetermined time delay after the varying signal is provided.

14. An electronic flash unit as claimed in Claim 13, said audible signal means being activated by a predetermined portion of the varying signal.

15. An electronic flash unit as claimed in Claim 13 or Claim 14 when dependent on Claim 8, said control signal means being electrically coupled to said visual signal means and said audible signal means for providing said varying signal to said audible

signal means said varying signal being indicated when said visual signal means produces the visual signal, the varying signal providing, at a predetermined portion thereof, the activation of said audible signal means.

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16. An electronic flash unit as claimed in Claim 13 or Claim 14 when dependent on Claim 9 or Claim 10, said control signal means being electrically coupled to said gas tube and to said audible alert signal means for providing said varying signal to said audible alert signal means, a predetermined portion of the varying signal being capable of activating said audible alert signal means.

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17. An electronic flash unit as claimed in Claim 12 wherein said control signal means provides a varying signal and said audible alert signal means is activated only during a predetermined portion of the varying signal.

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18. An electronic flash unit as claimed in Claim 17 further including a switching means electrically coupled to said signal means and to said means for producing an audible alert signal, the predetermined portion of the varying signal of said signal means activating said switching means which in turn activates said means for producing an audible alert signal.

19. An electronic flash unit as claimed in

Claim 18 wherein said signal means is a capacitor and the varying signal is an increasing signal which activates said switching means at the beginning of the predetermined portion of the varying signal and deactivates said switching means at the end of the predetermined portion of said varying signal thereby realizing an audible alert signal of a predetermined duration.

20. An electronic flash unit as claimed in Claim 11, further including a switching means electrically coupled to said audible alert signal means and to said control signal means, said switching means having a conductive and a nonconductive state, said switching means being in its conductive state only when a predetermined portion of the varying signal is applied thereto, thereby providing the audible alert signal.

21. An electronic flash unit substantially as described herein with reference to the accompanying drawings.

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