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PHOTOFLASH LAMP

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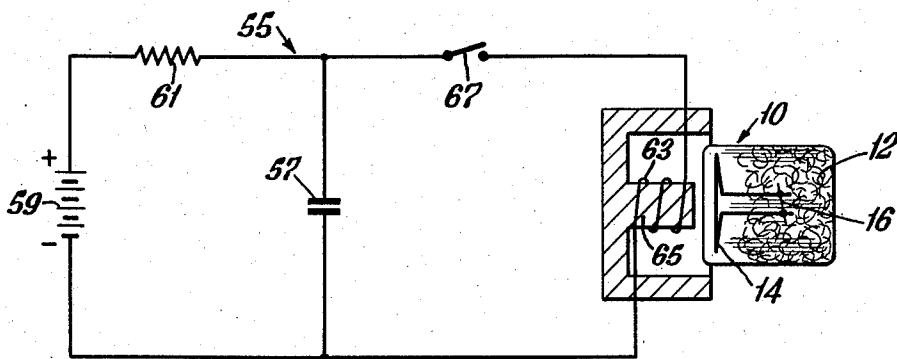
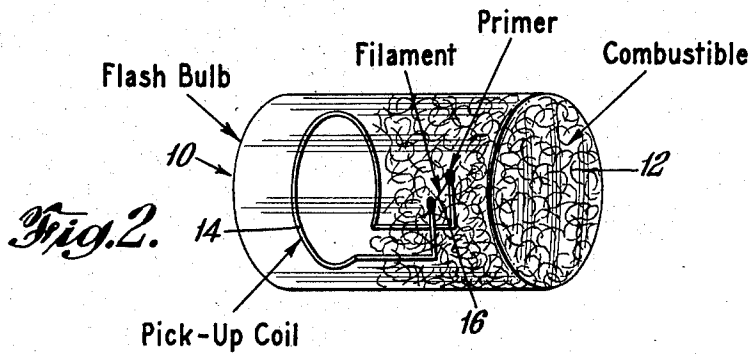
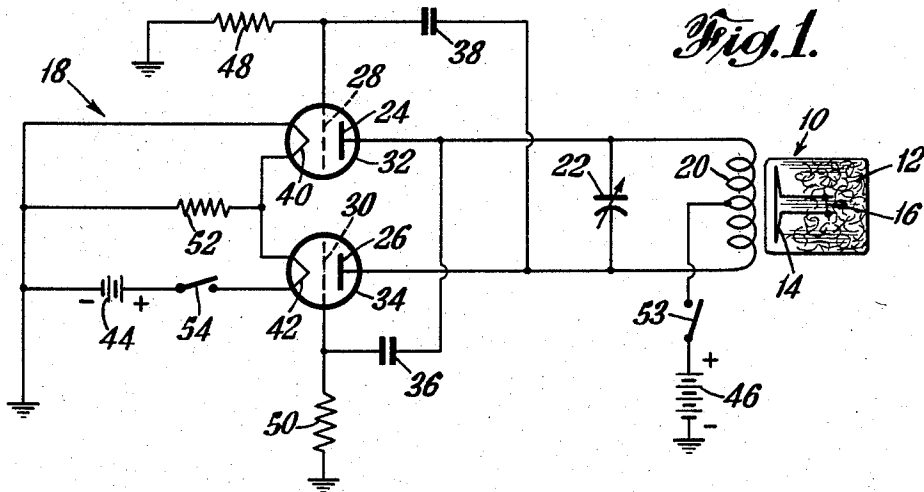


Fig. 3.

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PHOTOFLASH LAMP

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This invention relates to photoflash lamps, and more particularly concerns an improved photoflash lamp which is ignited by an external high frequency discharge.

Photoflash lamps, with their employment of a light-producing combustible material, a combustion-supporting gas and a primer material, have been constituted in many ways. Conventional flash lamps generally have a base provided with terminal contacts for the application of an electrical current. The current energizes the primer inside the lamp, which in turn ignites the combustible light-producing element. Photoflash lamps of this type are equipped with a base, a glass enclosure, a base cement for securing the glass enclosure to the base, lead-in wires and a metal to glass seal. Since the conventional photoflash lamp is expendable, being used for one time only and then discarded, the provision of such features is one of the major factors contributing to its relatively high cost.

It is, therefore, an important object of the present invention to provide an improved photoflash lamp, which is simple in structure and inexpensive to produce.

Another object of the present invention is to provide in a photoflash bulb having light-producing material therein, improved electrical means for effecting ignition of said light-producing material from a source outside said bulb without the requirement of lead-in wires or direct physical contact with said bulb.

In the drawings:

Fig. 1 is a wiring diagram of an illustrative ignition and supply circuit embodying the principles of the present invention;

Fig. 2 is an enlarged isometric view detailing the elements of the photoflash lamp of the invention; and

Fig. 3 is a modification of the ignition and supply system shown in Fig. 1.

In accordance with the invention, the interior of a photoflash bulb is provided with an inductive pick-up coil adapted to be electro-magnetically coupled to a suitable form of pulse generating source located in proximity to the outside of the bulb. Secured in series to the pick-up coil is a filament with primer material for igniting the combustible light-emitting material in the photoflash bulb.

The term "pulse" as used hereinafter is not intended to be limiting, but is intended to apply generally to pulses, such as square wave pulses and resonant pulse trains, either damped or undamped, or other suitable pulses of finite duration.

Referring to Fig. 2 in the drawing, a hermetically sealed photoflash bulb 10 of glass or other light-pervious material is provided with a suitable light-producing combustible material 12, such as metal combustible, for example, aluminum foil or shavings. A pick-up coil 14 having a filament and primer material 16 connected in series therewith is disposed within the confines of the bulb 10, and sealed therein.

According to the invention, ignition of the primer 16 is accomplished by means of an external energy source

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in proximity with the photoflash bulb and in spaced relation therewith, so that the necessity for lead-in wires is entirely eliminated. The external supply circuit may comprise a high frequency pulse circuit of the capacitor discharge or oscillator type. The oscillating circuit generates a pulse for producing a voltage impulse in a series-connected inductive impedance constituting the primary winding of a transformer. The pick-up coil inside the photoflash lamp is electromagnetically coupled to the primary winding, and constitutes the secondary winding of the transformer. Energization of the oscillating circuit creates a starting impulse in the primary winding, and induces a current pulse in the proximately spaced flash lamp pick-up coil sufficient to ignite the primer and discharge the combustible flash lamp material.

A pulse circuit employed in the practice of the invention may comprise a push-pull negative resistance oscillator 18 in which the oscillations developed across a primary winding 20, having a tuning capacitance 22, are generated by the rapid shifts of potential in plates 24, 26 and grids 28, 30 in tubes 32, 34, respectively. To sustain oscillations, the output of tube plate 24 supplies an input voltage of exactly the right phase to the grid 30 of tube 34 through a capacitance coupling 36, connected on one side to the grid 30 and on the other side to the plate 24. Similarly, the output voltage of plate 26 is coupled to the grid 28 of tube 32 by means of a capacitance 38. The cathode or filament elements 40 and 42 of tubes 32 and 34, respectively, are each connected to a low voltage source of direct current supply 44, controlled by a switch 54. A second source of direct current supply 46 having a higher voltage in comparison to the voltage of the first voltage source 44 is connected to the mid-point of the primary winding 20. The grids 28 and 30 are connected to ground through resistances 48 and 50. If so desired, the tubes 32, 34 may be united into a single tube having dual triode elements. Where the tube filaments are joined together, a resistance 52 is provided across one of the filaments to ground. Completion of the circuit 18 is accomplished by means of a closure switch 53, after first closing the switch 54.

Circuit constants which have produced about 34 milliseconds time delay from switch closure to light intensity peaks are as follows:

The primary winding comprises eight turns of No. 12 tinned copper wire having a one inch inside diameter, and having a calculated inductance of 0.88 microhenries. The tuning capacitance 22 has a capacitance ranging between 20 and 70 micromicrofarads. Capacitances 36 and 38 each have a capacitance of 50 micromicrofarads. Grid resistances 48 and 50 each have a resistance of 3900 ohms. The duotriode tube element is a 3A5 tube. The resistance 52 is 68 ohms. The low voltage supply source 44 is three volts, and the high voltage supply source 46 is 150 volts. The pick-up coil 14 consists of one turn of No. 22 copper wire.

For reducing the time between closure of the switch and maximum light output of the photoflash lamp, the modified firing circuit 55 shown in Fig. 3 is preferred. Circuit 55 comprises one or more condensers 57 charged by a source 59 of direct current through a high resistance 61. Connected to the terminals of the condenser 57 is a primary winding 63 having a ferrous core structure 65, preferably of the open type. The wound core 65 is capable of producing a varying electromagnetic field which transfers power across the finite but relatively short air space by inducing a current in the proximately positioned secondary coil winding 14 enveloped in the photoflash lamp 10. A control switch 67 connected in series with the primary winding 63 between the primary winding and the capacitance 57 initiates a starting pulse when the switch is closed.

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Ignition circuit arrangements constructed in accordance with the arrangement shown in Fig. 3 have been successfully tested with the following range of circuit characteristics.

Direct current source 59 ----- 22½ v. to 500 v.
 Condenser capacitance 57 ----- 0.100 mfd. to 250 mfd.
 Primary winding ----- 6 to 12 turns.
 Secondary winding ----- 1 to 8 turns.

In actual tests, time delays between switch closure and light peak of 20 milliseconds have been obtained using the following circuit constants:

Direct current source 59 ----- 130 v.
 Condenser capacitance 57 ----- 2 mfd.
 Resistance 61 ----- 470 K. ohms.
 Primary winding ----- 6 turns.
 Secondary winding ----- 1 turn.

From the above it will be seen that the present invention provides a novel flash bulb construction comprising a hermetically sealed envelope having a coil connected across a bulb filament. Without lead-in wires or other physical connections, the flash bulb may be ignited from an external energy source which is in proximately spaced relation to the flash bulb and electro-magnetically coupled thereto.

It will be understood that modifications and variations may be effected without departing from the spirit and novel concepts of the present invention.

What is claimed is:

1. In combination with an external high frequency electro-magnetic radiation pulse-producing means for producing a short period of pulse, an enclosed envelope type flash lamp having light-producing combustible material, a combustion supporting means therefor, and a high frequency electromagnetic pulse receiving coil therein, said coil being substantially loosely magnetically coupled to said pulse-producing means as the secondary winding of

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a transformer to effect ignition of said light-producing material and produce a flash of light.

2. In combination with a pulse-producing means having a transformer primary winding, a sealed, baseless flash-lamp of the enclosing envelope type having combustible flash producing material and combustion supporting means therefor comprising an inductive pick-up means entirely within said lamp, said inductive pick-up means constituting a transformer secondary winding electro-magnetically coupled with said primary winding and capable of accepting a sufficient pulse of power from said primary winding to ignite combustible, flash producing material in said flashlamp.

3. In the combination according to claim 2, said pulse-producing means comprising an oscillating circuit having a tuning capacitance connected across said primary winding.

4. In the combination according to claim 2, said pulse-producing means having a condenser connected to a source of direct current through a high resistance, and a switch for connecting said condenser across said primary winding, said primary winding having an open type ferrous magnetizable core structure.

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