Dec. 15, 1942. F. F. SYLVESTER 2,305,561

FLASH LAMP

Filed Jan. 27, 1941

Fig.1.

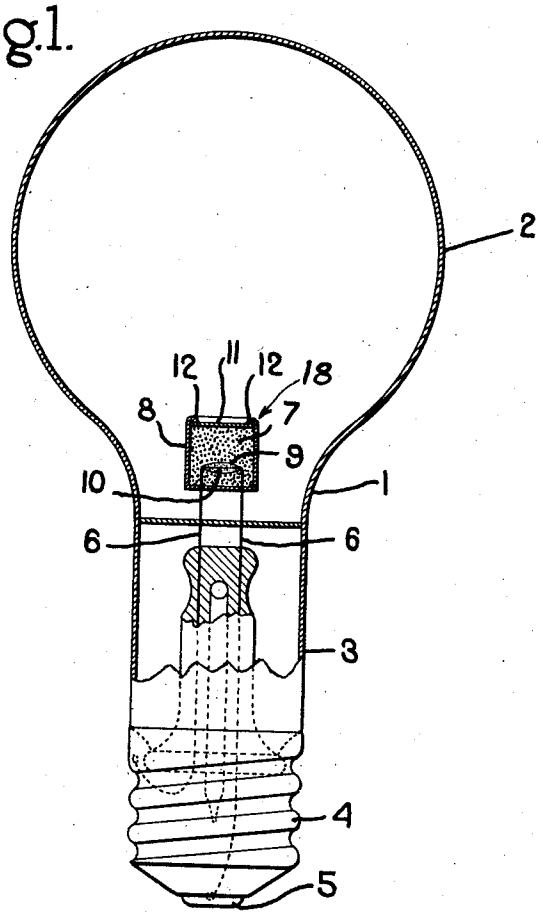
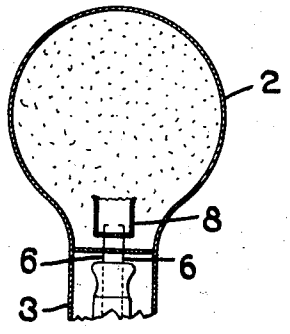


Fig.2.



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FLASH LAMP

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4 Claims. (Cl. 67—31)

This invention relates to flash lamps and particularly to a flash lamp of the type in which the bulb is filled with combustion-supporting gas and in which the flash is produced by exploding a cartridge or receiver containing a charge of the powdered combustible material, thereby to distribute such material throughout the bulb in the form of a fine dust spray that becomes intimately mixed with combustion-supporting gas, and simultaneously igniting the dust-laden gas to produce the flash emitting actinic light.

One object of the invention is to provide a flash bulb of this type which is constructed in a novel way to furnish protection against premature ignition of the bulb from the transfer of radiated heat from an external source.

A further object of the invention is to provide a novel method of operating the flash lamp so as to obtain actinic light outside the visible spectrum.

Further objects of the invention are to improve generally flash lamps of the above type in the manner hereinafter more fully set forth.

In the drawing:

Fig. 1 is a sectional view of a flash lamp embodying my invention.

Fig. 2 is a fragmentary sectional view on a smaller scale illustrating the exploded cartridge or container.

In the drawing, 1 indicates the flash lamp embodying my invention which comprises a transparent or translucent bulb 2 having any usual or desired configuration, and filled with a suitable combustion-supporting gas, preferably at a pressure less than atmospheric pressure, said bulb being provided with a neck portion 3 which is sealed to the stem through which the lead-in wires 6 pass into the bulb from the outside. The neck of the bulb at the seal is cemented or otherwise suitably affixed to the usual screw type or bayonet base. The lead-in wires 6, as indicated in the drawing, connect to the metallic terminal 4 and end terminal 5.

The combustible material 7 for producing the flash is in powdered or finely comminuted form and is enclosed in a case, capsule or other suitable container 8 which is herein shown as mounted on the lead-in wires 6, said case 8 with its filling of combustible material 7 constituting an explosive cartridge which is indicated generally by the reference numeral 18.

Means are provided for exploding the cartridge 18, thereby to discharge the powdered combustible material therefrom in the form of a fine dust spray which becomes intimately mixed with the combustion-supporting gas within the bulb and at the same time for igniting the dust-laden gas to produce the flash emitting actinic light.

In the preferred form of my invention, I propose to employ an electrically actuated detonating primer for thus exploding the cartridge 18, such primer being indicated at 9. This primer may be constructed in various ways so long as it has the capacity of exploding the cartridge when it is detonated. In the illustrated embodiment of the invention, the primer is in the form of a filament 10 connecting the lead-in wires 6 and coated with a suitable fulminating substance. The filament is preferably one that is capable of heating to incandescence or burning out instantly (that is, in 1/100 or 1/1000 of a second, depending upon filament size and material) with as little as one volt impressed thereon, and the coating for the filament is some fulminating substance which becomes ignited and which detonates when the filament is thus heated to incandescence or burns out. The detonation of the detonating primer not only explodes the cartridge 18 and causes the powdered combustible material 7 to be sprayed or blown out into the bulb and to be well distributed throughout and intimately mixed with the combustion-supporting gas, but also preignites the combustible material and thereby causes ignition of the dust-laden gas, which produces a dust explosion that developes the flash of actinic light.

Any suitable combustion-supporting gas may be used, or any mixture of gases that will produce an atmosphere in the bulb capable of supporting combustion. Oxygen makes a very practical gas for this purpose, and it is desirable that the gas pressure in the bulb should be somewhat less than atmospheric pressure, since at this low pressure the expansion of the gases resulting from combustion does not develop any pressure great enough to shatter the bulb. I find that a pressure of 200–700 mm. Hg. is suitable.

For the powdered combustible material 7, I preferably use a pure metal such as powdered aluminum, or a combination of powdered aluminum and powdered magnesium, or a powdered alloy of both metals, or any other similar powdered metals which, upon rapid oxidation, generate actinic light. The advantage of using pure metal for the combustible material is that the oxidation of it will produce only pure metallic oxides which are neither dense or opaque and which do not cloud the interior of the bulb but permit the passing of practically all the light from the retaction within the bulb.

Such pure metallic powder, when in a dense mass, is normally incombustible in air at temperatures even up to that which will char paper, but when the pure metallic powder is distributed throughout and intimately mixed with the combustion-supporting gas within the bulb, the mixture or dust-laden gas is highly combustible, and, when ignited, a dust explosion takes place which produces the flash of actinic light.

The detonating primer may be composed of a wide variety of materials which will be detonated or ignited by the incandescent filament 10. Some materials suitable for this purpose are a mixture of powdered red phosphorus and potassium chlorate, or manganese peroxide, and I will preferably incorporate with these detonating materials a suitable binder of thin consistency such as glue, lacquer, varnish, sugar, glucose, dextrose or gum, etc., which holds the particles together and retains the shape of the primer. The primer may also be formed of zirconium metal and manganese peroxide with any of the above binders, or any other stable fulminating material which is safe to handle.

It is important, of course, that the cartridge case or capsule 8 should be made so that it will be readily burst open when the primer is detonated thereby liberating the combustible material in the form of a fine dust spray. This cartridge case or capsule 8 may be made of paper, cardboard, fibre, or plastic material, and it is shown as having a body portion open at one end, which open end is closed by a wad or closure 11 that may be held in place by crimping over the ends of the side walls of the body, as shown at 12. This cartridge case or container, however, may be made in various ways provided it is constructed so that it will readily burst open when it is exploded to allow the discharge of the powdered material in a fine dust spray.

It is a characteristic of my invention that the powdered combustible material 7 is discharged from the cartridge case or container 8 in the form of a fine dust spray and becomes intimately mixed with the combustion-supporting gas before the flash occurs, although the detonating of the primer actually starts the ignition of the combustible material as the explosion takes place. The complete flash, or flash peak, however, does not occur until after the powdered material has been thoroughly mixed with the combustion-supporting gas.

Since the pressure of the combustion-supporting gas in the bulb is less than atmospheric pressure, the expansion of the gases resulting from the combustion does not develop any pressure within the bulb great enough to shatter or burst it.

The character or color of the light emitted by the flash can be varied by incorporating in the combustible material some suitable compounds for coloring or controlling the spectrographic range of actinic light. For instance, the addition of barium nitrate to the combustible material will give a green character to the light produced by the flash, the addition of strontium nitrate will give a red characteristic to the light, the addition of sodium nitrate will give a yellow characteristic to the light, while the addition of lithium nitrate will give a blue characteristic. Reference to the above-mentioned color-producing ingredients is given only for the purpose of illustrating the possibility of varying the color characteristic of the light produced by incorporating different metals or metal salts in the combustible material.

It is also possible to vary the time or duration of the peak of the illumination generated by the bulb by varying the particle size of the powdered combustible material.

The time duration between application of current to the filament and the actual peak of illumination can also be controlled by varying the contents or ingredients of the detonating primer or by varying somewhat the character of the binder used in the primer for holding the detonating chemicals together.

My improved flash lamp has a number of worthwhile safety features, foremost of which is the entire freedom from ignition or spontaneous ignition of the bulb either through actual contact with heat through the transparent wall of the bulb or by friction between the charge of combustible material and the primer, or by electrostatic ignition by corona or spark discharge. I have stated above that the cartridge case 8 may be made of paper, or cardboard, or plastics, materials which have heat-insulating and dielectric characteristics.

Since the entire charge of powdered combustible material and the primer are sealed within a cartridge case having heat-insulating properties, such combustible material and primer are thereby shielded from transfer of heat from an external source which might prematurely ignite the charge. Moreover, the primer, being embedded in the powdered material 7, is thus completely surrounded by and in direct electrical contact with the powdered charge 7, which is a soft somewhat fluffy almost immobile mass, thereby eliminating the possibility of electrostatic discharge due to friction between the primer and the mass of combustible material.

In using a flash lamp embodying this invention, it has been observed that if an E. M. F. of twelve volts or more is impressed on the filament for detonating the primer, and such E. M. F. remains thus impressed throughout the entire cycle of combustion, ionization of the metal vapors or gases resulting from the reaction or combustion will result thus producing additional light. The additional light thus produced by ionization of the metal vapors is not wholly visible as light but is rather a combination of low frequency yellow and red light waves and high frequency violet light waves, or what might be technically referred to as infra-red and ultra-violet light rays. The quality and quantity of this light resulting from ionization depends upon the character of the material or materials used in the charge of the flash bulb, and while some of the light generated by the ionized gas is in the visible spectrum and adds materially to the volume of light produced by the flash bulb, yet much of such light is infra-red and ultra-violet light, which is actinic but is outside of the visible spectrum, as stated above.

I claim:

1. The method of producing a flash in an electrically actuated flash lamp in which the bulb contains a combustion-supporting gas and the lead-in wires support a cartridge containing powdered combustible material and a detonating primer carried by a filament connecting said wires, which method consists of impressing excessive E. M. F. across the filament, thereby (1) burning out the filament, (2) detonating the primer, (3) exploding the cartridge, (4) distributing the powdered combustible material

throughout the bulb as a dust spray and (5) igniting the dust-laden gas, and securing ionization of the metal vapors or gases resulting from the combustion by prolonging sufficiently the time interval during which the excessive E. M. F. is impressed across the lead wires to cover the entire cycle of combustion, whereby actinic light outside the visible spectrum is produced.

2. The method of producing a flash in an electrically actuated flash lamp in which the bulb contains a combustion-supporting gas and lead-in wires supporting a cartridge containing powdered combustible material and a detonating primer carried by a filament connecting said wires, which method consists of impressing excessive E. M. F. across the filament, thereby (1) burning out the filament, (2) detonating the primer, (3) exploding the cartridge, (4) distributing the powdered combustible material throughout the bulb as a dust spray and (5) igniting the dust-laden gas, and maintaining the excessive E. M. F. so impressed across the lead wires during the entire cycle of combustion, whereby the metal vapors and gases resulting from the combustion are ionized, thereby producing actinic light outside the visible spectrum.

3. A flash light bulb having a hollow bulb element containing a combustion-supporting gas at less than atmospheric pressure, a cartridge within the bulb element comprising a cartridge case of paper loaded with combustible material in powder form and a detonating primer located within and entirely surrounded by the mass of combustible material, said cartridge case having a cup-shaped body portion and a displaceable closure member fitting within the open end of the body portion, the edge of the latter being bent inwardly over the peripheral edge of the closure member thereby to temporarily hold the closure member in place, and means to detonate the primer, thereby both to explode the cartridge by blowing the closure member off from the case and to distribute the powdered material throughout the bulb element in the form of a fine dust spray which becomes intimately mixed with the combustion-supporting gas and also to ignite the dust-laden gas, the heat-insulating characteristics of the cartridge case together with the protection afforded by the walls of the bulb serving to shield the combustible material and the primer from transfer of radiated heat from an external source which might prematurely ignite the charge.

4. The method of producing a flash in an electrically actuated flash lamp in which the bulb contains a combustion-supporting gas, a combustible material and a detonating primer carried by the filament connecting the lead-in wires, which method consists in impressing excessive E. M. F. across the filament, thereby (1) burning out the filament, (2) detonating the primer, (3) igniting the combustible material, and maintaining the excessive E. M. F. so impressed across the lead wires during the entire cycle of combustion, whereby the metal vapors and gases resulting from the combustion are ionized, thereby producing actinic light outside the visible spectrum.

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