

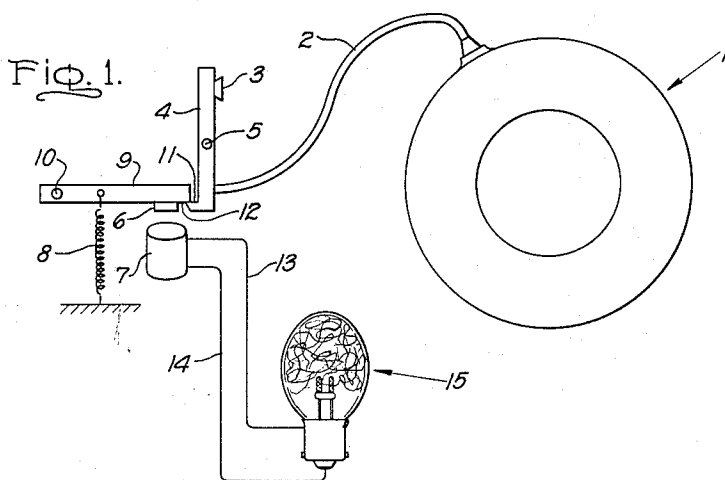
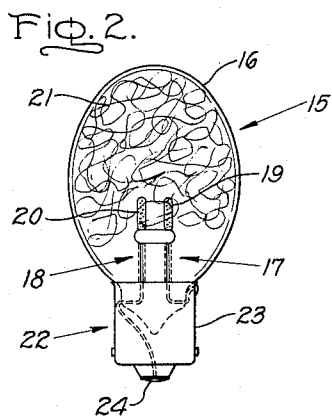
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FLASH APPARATUS

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3,106,080 FLASH APPARATUS

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Original application Mar. 14, 1958, Ser. No. 721,430, now Patent No. 2,972,937, dated Feb. 28, 1961. Divided and this application May 11, 1959, Ser. No. 812,234
3 Claims. (Cl. 67-31)

This invention relates in general to flash photography and more particularly to a new and novel apparatus for initiating the ignition of a photoflash lamp of the type used for photographic purposes to produce a flash of actinic light. A photoflash lamp of the type herein referred to is characterized in that its light output is due primarily to chemical reaction rather than to electrical energy. The present application is a division of my co-pending application Serial No. 721,430, filed March 14, 1958 now Patent No. 2,972,937, issued February 28, 1961 and assigned to the assignee of the present application.

One type of photographic flash lamp commonly in use at present comprises a sealed glass envelope or bulb having a charge of readily combustible metal foil loosely arranged within the bulb, a filling of a combustion supporting gas, and ignition means extending into the envelope and comprising primer of fulminating material coated on the inner ends of said means. When such a lamp is flashed, combustion is initiated by the igniting of the primer material, which in turn ignites the charge of readily combustible material. The combustible material reacts with the gaseous filling to produce a momentary flash of light of high intensity suitable for photographic purposes. The presently available commercial power pack employed to initiate ignition of the primer material comprises either a battery and condenser unit or a battery alone. While a power pack of this type produces good results under proper conditions, yet there exist certain difficulties such as failure of the lamp to fire if the battery should be weakened or run down or if there should be relatively poor contact in the circuit, as for instance between the lamp base and its socket. Further, the above described power source has an appreciable weight and volume so that certain inconveniences are associated with its portability, particularly to the amateur photographer.

It is an object, therefore, of my invention to overcome the aforesaid difficulties by providing an improved apparatus for flashing photoflash lamps.

Another object of my invention is to provide an improved power source for flashing photoflash lamps.

Still another object of my invention is to provide an improved light flash producing combination of a flash lamp and an associated electrical power supply means for flashing the lamp.

In accordance with one aspect of the invention, a photoflash lamp power pack or electrical energy supply means comprises a piezoelectric crystal arranged to provide a conducting path to the terminals of the photoflash lamp, and means deforming the crystal to produce the electrical energy required to flash the lamp. The deformation of the crystal may be accomplished by, for example, striking the crystal a sharp blow, or releasing the pressure on a prestressed or preloaded crystal.

The invention will best be understood by reference to

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the following detailed description and to the drawings wherein:

FIG. 1 is a diagrammatic view of a camera shutter, a piezoelectric crystal, and a flash lamp arranged according to the present invention; and

FIG. 2 illustrates one flash lamp found particularly well suited for flashing with the power pack of the instant invention.

Referring to FIG. 1, there is shown a conventional camera shutter 1 actuated in a conventional manner by a cable release 2. The cable release 2 is operated by manual movement of knob 3 to the left, thereby rotating lever 4 about the stationary fulcrum 5 so as to depress or actuate the cable release 2 and thereby actuate the shutter. A hammer 6 is biased toward a piezoelectric crystal 7 by means of a spring 8 which tends to rotate a lever 9, carrying the hammer 6, about the stationary fulcrum 10 in a clockwise direction. Rotation of lever 9 is prevented by the engagement of the trigger projection 11 of lever 4 with the right end 12 of lever 9. However, simultaneously with the operation of the cable release 2 by movement of the knob 3 to the right, projection 11 disengages the end 12 of lever 9 permitting the hammer 6 to strike the crystal 7 due to the biasing action of the spring 8 on the lever 9. The blow of the hammer 6 upon the crystal 7 deforms the crystal slightly, changing its dimensions slightly, and developing a voltage across its two faces. The voltage developed across the faces of the crystal 7 is conducted by appropriate conductors 13, 14 to a flash lamp 15.

After the lamp 15 has been flashed in the aforesaid manner, the hammer 6 may be manually reset by engagement of trigger portion 11 of lever 4 with the end portion 12 of lever 9 so that the firing mechanism is in proper position for further firing of another flash lamp.

The crystal 7 is such that when given a sharp blow it emits a momentary voltage of steep wave front. While Rochelle salt crystals may be employed, I prefer to employ a piezoelectric crystal of barium titanate which will yield a voltage of some 200 to 1000 volts for a duration of a few microseconds with a total energy in the order of microwatts. A barium titanate piezoelectric crystal of about 1/8 inch in diameter and 1/8 inch thick will yield a potential of about 450 volts and has been employed satisfactorily for this purpose. However, a barium titanate crystal having larger dimensions would generate even greater energy in response to an appropriate mechanical deformation.

One type of flash lamp readily flashed by the discharge of a piezoelectric crystal according to the present invention is illustrated in FIG. 2. The lamp is of the filamentless type more fully described and claimed in U.S. Patent 2,868,003, Warren F. Albrecht, issued January 13, 1959, and assigned to the assignee of the present application, and need not be fully described herein. However, briefly, the lamp comprises a radiation transmitting bulb 16 preferably of glass. The bulb has hermetically sealed therein two electrodes 17, 18 which extend into the interior of the bulb and may be made of any suitable metal such as iron, copper, aluminum, nickel, etc. The electrodes 17, 18 are coated with a porous primer 19, 20, respectively, which may be of a composition generally employed in the art and well known in the art. Such primers generally comprise a porous mixture of a readily ignitable metallic powder such as zirconium or a mixture

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of zirconium with magnesium, and an oxidizing agent such as potassium perchlorate, bonded together by a suitable binder such as nitrocellulose. By way of example, a suitable primer composition may consist of, by weight, 90% zirconium and 10% potassium perchlorate, formed as a suspension in a solution of nitrocellulose and amyl acetate and having a viscosity of about 24 centipoises x grams per cubic cm. The bulb 16 further contains a filling of a loose mass of combustible material 21, preferably in the form of shredded aluminum foil such as that in conventional type flash lamps. The bulb also contains an atmosphere of combustion-supporting gas, preferably oxygen at a suitable pressure which may be below or above atmospheric. The lamp may have any desired form of base 22. The electrodes 17, 18 are electrically secured to contacts 23, 24 which may form part of the base 22 and which may be electrically secured to conducting wires from the piezoelectric crystal 7, such as conducting wires 13, 14 (FIG. 1).

The combustible material 21 forms a conducting path between the electrodes 17, 18 from which the foil is physically separated only by the normally insulating porous primer coating on one or both of the electrodes. The lamp is flashed by a power surge from the piezoelectric crystal 7. The voltage appearing across the terminals 23, 24 forms small arcs in completing a current path inside the lamp. This path starts from one electrode 17, arcing through the primer coating 19 to the foil 21 and through the foil to the other electrode 18 through the primer coating 20, thus completing the circuit. The small arc or arcs thus formed ignite the primer coatings 19, 20 which, in turn, ignite the foil 21 to flash the lamp. As explained above, the power surge is obtained by deforming the piezoelectric crystal 7 so as to cause it to emit a momentary voltage sufficient to flash the lamp.

It will be noted that the gap between the electrodes 17, 18 is much too large to sustain a discharge directly therebetween through the gaseous atmosphere in the bulb when employing a piezoelectric crystal as the power source. In order to sustain a discharge directly between the electrodes from a piezoelectric crystal source, the electrode spacing would have to be of the order of $\frac{1}{100}$ inch; obviously, it would be inordinately difficult to maintain such spacing on a commercial mass production basis. Neither is it feasible to flash any of the lamps heretofore proposed and of which the applicant is aware, whether of the type containing a filament or of the arc type, by employing a piezoelectric crystal as the source of power. In the case of the filament type lamp, the energy level of the surge from the crystal is too low to heat the filament to a sufficiently high temperature to ignite the primer, and in the case of the arc type lamps the energy level is likewise too low to form an arc in the lamp constructions heretofore proposed. Accordingly, from a practical manufacturing standpoint, it is desirable for the purposes of the invention to employ the flash lamp construction as disclosed herein and shown in FIG. 2 where the combustible foil is arranged to form a conducting path or bridge between a pair of internal electrodes.

The piezoelectric crystal 7 arranged according to the present invention and synchronized with a shutter, as by a cable release as illustrated in FIG. 1, has very attractive features as a battery-less flash lamp igniter. The barium titanate crystal has a long life and is extremely reliable. The combined shutter mechanism, crystal, and associated deforming mechanism may be assembled as a complete article of manufacture and sold for use in many different types of cameras. Moreover, striking or deforming mechanisms for such piezoelectric crystals may be built into many different types of shutter mechanisms. It is only necessary to synchronize the voltage impulse from the crystal to the operation of the shutter so as to flash the lamp at the proper time.

Further, it is seen from the above aforesaid dimensional

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description of the barium titanate crystal 7 that while the crystal produces an electrical potential of substantial voltage, in the range of 200 to 1000 volts, the short duration of the potential, in the range of a few microseconds, yields a very small total energy output which may be in the order of a few microwatts. It is, therefore, particularly advantageous in practicing the invention to employ a low-energy initiated lamp, i.e., of the type which can be flashed by a low-energy impulse of the order of microwatts such as that described herein, in order to insure constant and reliable firing of the lamp. However, a suitable sized piezoelectric crystal can, of course, generate considerably more energy in response to a sufficient mechanical deformation than the aforesaid barium titanate crystal 7 described above in connection with FIG. 1.

While certain specific embodiments of the invention have been shown by way of illustration, it is to be understood that many modifications will occur to those skilled in the art. The invention is to be limited only by the claims annexed to and forming a part of this specification.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, a photographic flash lamp comprising a sealed radiation-transmitting bulb, a quantity of readily combustible material in said bulb comprising a primer material, a pair of spaced metallic electrodes extending into said bulb, one of said electrodes having substantially its full length within the bulb coated with electrically insulating material, at least a portion of said insulating material consisting of said primer material, metallic electrically conductive means in contact with said primer and forming an electrically conductive path from said one electrode through said primer and conductive means to the other one of said electrodes for formation of a spark discharge between said one electrode and said conductive means through said primer upon application of a high-voltage low-energy impulse to said electrodes, a combustion-supporting atmosphere in said bulb, and a piezoelectric crystal connected across the electrodes of said lamp and forming the source of electrical energy for flashing the lamp.

2. In combination, a photographic flash lamp comprising a sealed radiation-transmitting bulb, a pair of spaced metallic electrodes extending into said bulb, one of said electrodes having substantially its full length within the bulb coated with electrically insulating material, at least a portion of said insulating material consisting of a primer, a loose mass of metallic combustible material substantially filling said bulb and in contact with both the primer on said one electrode and with the other electrode and forming an electrically conducting path therebetween for formation of a spark discharge between said one electrode and the combustible material through said primer upon application of a high voltage low-energy impulse to said electrodes, a combustion-supporting atmosphere in said bulb, a piezoelectric crystal connected across the electrodes of said lamp and forming the source of electrical energy for flashing the lamp, and means for deforming said crystal whereby the crystal yields sufficient energy to flash the lamp.

3. In combination, a photographic flash lamp comprising a sealed radiation transmitting bulb, a pair of spaced metallic electrodes extending into said bulb, one of said electrodes having substantially its full length within the bulb coated with electrically insulating material, at least a portion of said insulating material consisting of a primer, a loose mass of metallic combustible material substantially filling said bulb and in contact with both the primer on said one electrode and with the other electrode and forming an electrically conducting path therebetween for formation of a spark discharge between said one electrode and the combustible material through

said primer upon application of a high voltage low-energy impulse to said electrodes, a combustion-supporting atmosphere in said bulb, and a piezoelectric crystal connected across the electrodes of said lamp and forming the source of electrical energy for flashing the lamp, the said electrodes being spaced apart in the bulb a distance such that the gap therebetween is too great to sustain a discharge directly therebetween through the atmosphere in the bulb with the energy level available from the said piezoelectric crystal.

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