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L. WEISGLASS

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MEANS TO IGNITE PHOTOGRAPHIC FLASH LAMPS

Original Filed April 14, 1943

Fig:1

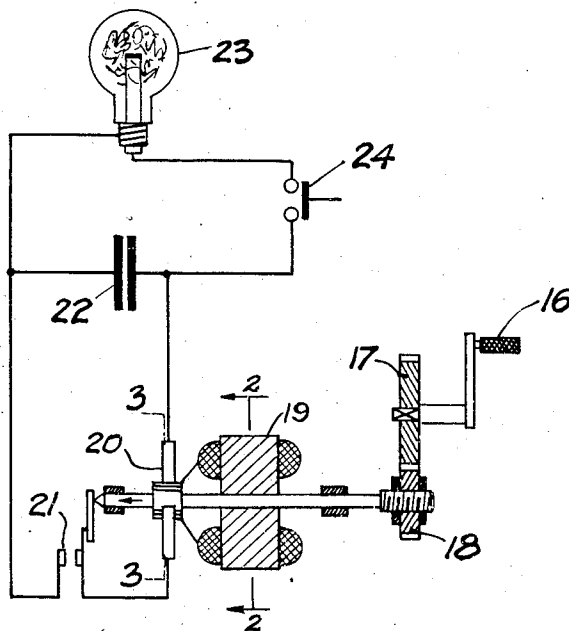


Fig:3

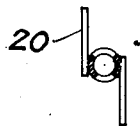
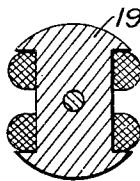


Fig:2



LOUIS WEISGLASS
INVENTOR.

BY *Walter E. Wollheim*
ATTORNEY

UNITED STATES PATENT OFFICE

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MEANS TO IGNITE PHOTOGRAPHIC FLASH LAMPS

Louis Weisglass, New York, N. Y., assignor to
Simmon Brothers, Inc., Long Island City, N. Y.,
a corporation of New York

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482,999. Divided and this application Decem-
ber 6, 1943, Serial No. 513,082

2 Claims. (Cl. 67—31)

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This invention pertains to a novel means of igniting photographic flash lamps and is a division of a copending application, Serial #482,999, filed April 14, 1943.

Photographic flash lamps consist of a glass vessel filled with oxygen and containing aluminum or magnesium in some suitable form (usually thin wire or thin foil). A filament, usually coated with a combustible substance, is provided, and the combustion of the metal is initiated by electrically heating the filament. On portable photographic equipment, such as hand cameras, the current for this purpose is supplied by dry battery.

A certain time elapses between the instant when the operator closes the electric circuit and the time when the ignited aluminum or magnesium emits the peak of its light emission. This time lag is usually approximately twenty milliseconds and is longer than the time necessary to open an average photographic shutter which usually requires approximately seven milliseconds. Therefore, mechanical devices called "synchronizers" are used by means of which the electrical circuit is closed and the shutter opened with the proper time interval so that the lamp is approximately at the peak of its light emission for the duration of the shutter opening. The design of these synchronizers does not form part of this invention and a detailed description is therefore omitted.

Synchronizers very frequently do not function as consistently as desirable and the time which elapses between the closing of the circuit and the peak light emission varies so that very often the combustion of the aluminum or magnesium has already progressed too far or not far enough when the photographic shutter is actually wide open.

It has been found that this is almost entirely due to the fact that the internal resistance of a battery increases appreciably with age. A new battery has a very low internal resistance enabling it to supply a high current to the filament, thus starting the combustion within a very short time. The internal resistance of an older battery increases more or less slowly during its useful life and increases very rapidly thereafter so that the battery becomes useless, i. e. the internal resistance becomes eventually so high that the current passing the filament will not render it sufficiently hot to initiate the combustion at all.

The operator has no means of judging whether a given battery is still good enough to effect proper synchronization and even if a battery is still "good enough" it still may ignite a flash lamp considerably slower than a substantially new battery.

The use of a dry battery has other disadvantages. Dry batteries suitable for this purpose

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are relatively heavy and bulky and this disadvantage becomes worse when it is desired to ignite several flash bulbs simultaneously. In certain regions it may also be difficult to obtain dry batteries for replacement and other disadvantages inherent to the use of dry batteries can be readily visualized.

For that reason it has occasionally been suggested to use small generators which are actuated either by a hand crank or the like or which are driven by a spring motor and which are supposed to deliver sufficient electric energy to initiate the combustion of the photographic flash bulb as described above. These attempts have not been successful heretofore chiefly due to the fact that the generator would have to be fairly large and that also provisions have to be made to rotate it with a constant speed since otherwise its voltage would not be constant and consequently the combustion would not be initiated with a constant time lag.

This generator must, of course, be rotated during the actual exposure and it will be clear that a rotating generator mounted on a hand camera is quite undesirable since even a very well balanced generator is apt to introduce vibrations.

It is the purpose of this invention to overcome these difficulties by providing a system which can be operated by a generator but without the disadvantages outlined in the preceding paragraphs.

I accomplish this by energizing the filament by means of which the combustion is initiated not directly from a generator but from a suitable condenser which in turn is charged prior to the exposure from a generator.

The invention is illustrated by means of the accompanying drawing in which a preferred embodiment is disclosed diagrammatically and in which

Fig. 1 is a circuit diagram in which a hand operated current generator is used;

Fig. 2 is a schematic cross section through the generator along the plane of line 2-2 in Fig. 1; and

Fig. 3 is a schematic cross section through a commutator of the generator along the plane of line 3-3 in Fig. 1.

Like characters of reference denote similar parts throughout the several views and the following specification.

In Fig. 1 is shown the condenser as energized by a generator. A hand crank 16 drives a large gear 17 which in turn drives a small gear 18. The small gear is held between two thrust bearings so that it cannot shift axially and a rather steep thread is cut into its center hole. This thread engages the generator shaft which is equipped with a corresponding male thread and which has sufficient axial play to permit a shift of approximately $\frac{1}{8}$ ". The generator rotor 19 is otherwise

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quite conventional and consists of a suitably shaped piece of soft iron surrounded by a coil of copper wire. The two ends of the coil are connected to a commutator 20 which again is quite conventional except that its segments are rather short. An auxiliary contact 21 is provided which is normally open and which will be closed as soon as the generator shaft moves in the direction of the arrow which it will do as soon as crank 16 is rotated. 22 is a condenser. 23 is a flash bulb and 24 is a normally open contact. The generator rotor is surrounded by a permanent magnet of conventional design which is not shown in this diagram.

The operation of this device is as follows:

Prior to exposure, the operator turns hand crank 16 several times. This causes gears 17 and 18 to rotate which forces the rotor first to shift axially to close contact 21, and then to rotate. This generates an electrical current charging capacitor 22. After the operator ceases to rotate hand crank 16, the rotor will return to its original position since it is biased by a spring provided for this purpose which however is not shown in the drawing. The opening of switch 21 prevents the condenser from discharging again through the rotor windings themselves. For the same reason the commutator segments have been made quite short so that the condenser during the charging period is connected to the rotor coils only during the peak of the generated sine waves.

After the condenser is charged, it will keep its charge for a fairly long period of time, usually several minutes, and the operator merely has to push switch 24 in order to ignite the flash bulb. Switch 24, of course, can be mechanically connected to a synchronizer in the usual manner, but since the synchronizer proper does not form part of this invention, this connection is not shown in the drawing.

I have found that the best conditions for a generator operated system can be obtained with a generator voltage of approximately 70 volts and a condenser capacity of approximately 20 microfarads.

It will be clear that a generator energized system of this type avoids all the disadvantages outlined before, and that vibrations are no longer a problem since the generator is merely rotated prior to the exposure and is standing still during the exposure itself. The bulk and weight of formerly proposed condenser outfits are reduced to a very small fraction of their former value, making the application of the generator, as defined herein, extremely practical and desirable for hand cameras in which light weight is paramount.

As long as the speed of the generator is above a certain speed, it will charge the condenser to a certain minimum voltage which, of course, must be chosen so high that it will ignite the filament with certainty. The minimum speed can easily be assured by providing a suitable gear transmission so that the operator simply cannot fail to provide at least this minimum speed and usually a great deal more. Under these conditions the time necessary to ignite the filament may vary from one to two milli-seconds which is negligible compared to the total time of twelve milli-seconds and which in no way will jeopardize the proper synchronization.

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If the condenser has the proper electrical dimensions, the stored energy is so large and the internal resistance of the condenser discharge circuit is so extremely low that it will ignite the filament within one or two milli-seconds. This has two advantages: first, it reduces the time lag from the time of closing the circuit to the peak emission of the lamp from the customary twenty-milli-seconds to approximately 12 which facilitates the design of a proper synchronizer, and second, it makes for practically 100% consistent results, since it will be obvious that if the time to ignite the filament amounts to only two milli-seconds, any possible fluctuation of this small time will be negligible as compared to the total time lag of approximately twelve milli-seconds. In other words, the time lag may vary approximately between eleven and twelve milli-seconds which is not nearly enough to throw the system out of proper synchronization, whereas with the old methods of using the generator directly I have found the time may vary between fifteen and thirty milli-seconds which obviously very often completely destroys the synchronization.

It will be understood that the generator circuit as shown is merely an example which can be modified in many ways which will be obvious to one skilled in the art. For example, instead of making the small gear 18 act as a nut and the generator shaft as a screw, gear 18 can be fastened directly to the shaft if gears 17 and 13 are helical gears which when rotated also exert a thrust in the direction of the arrow so that switch 21 becomes closed during the rotation of the generator. It is also possible to close switch 21 by a centrifugal governor so that the generator is again automatically disconnected from the condenser as soon as the generator ceases to rotate. Switch 21 may also be replaced by a suitable rectifier, preferably, of the copper oxide or selenium type. Modifications of this nature should be considered to fall within the scope of this invention.

Various other changes in details and disposition of parts may obviously be resorted to without departing from the principles or sacrificing any of the advantages of the invention as defined in the appended claims.

What I claim as new is:

1. The portable combination of a photographic flash lamp consisting of a light transmitting vessel containing a filament and a plurality of components adapted to combine chemically upon heating of said filament, an induction type generator for electric energy, a condenser for storing said energy, and indirect means to ignite said lamp by discharging said stored energy into said vessel to heat said filament to initiate chemical combination of said components.

2. The portable combination of a photographic flash lamp consisting of a light transmitting vessel containing a filament and a plurality of components adapted to combine chemically upon heating of said filament, an induction type generator for electric energy, a condenser for storing said energy, indirect means to ignite said lamp by discharging said stored energy into said vessel to heat said filament to initiate chemical combination of said components, and means to prevent energy from flowing backwardly from said condenser to said generator when the generator is inoperative.

LOUIS WEISGLASS.