

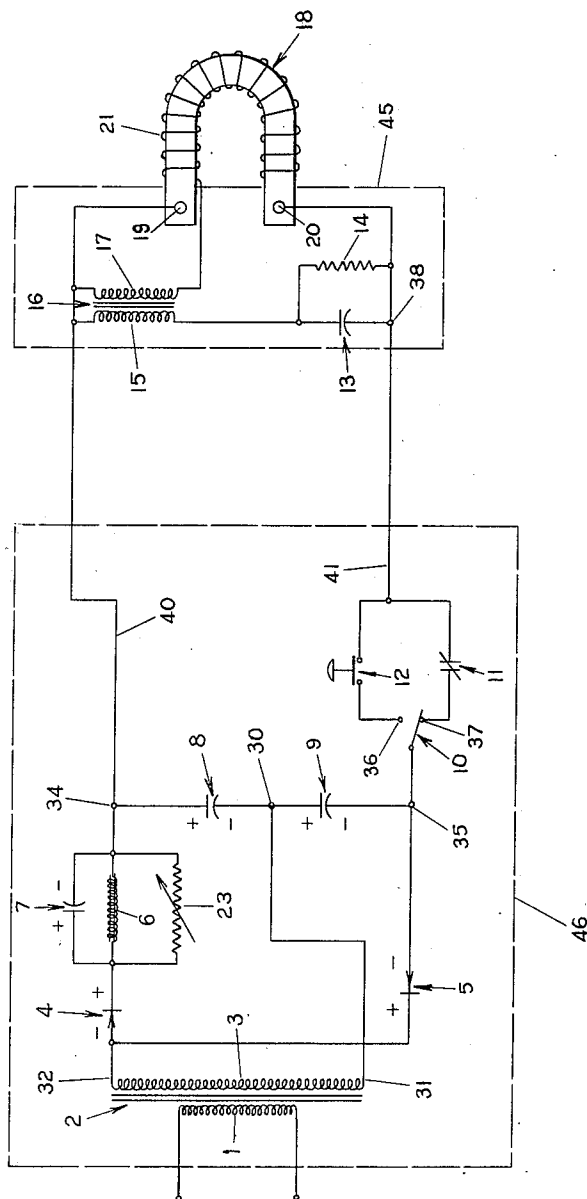
Feb. 10, 1953

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2,628,331

GAS TUBE ENERGIZING AND TIMING DEVICE

Filed Feb. 3, 1951



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UNITED STATES PATENT OFFICE

2,628,331

GAS TUBE ENERGIZING AND TIMING
DEVICE

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Application February 3, 1951, Serial No. 209,281

7 Claims. (Cl. 315—205)

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This invention relates to means for momentarily energizing a gas filled photoflash bulb and, more particularly, it relates to means for energizing same by which the photoflash bulb may be separated by a considerable distance from the power source and the connection thereto made with only two wires, which wires may carry current at a relatively moderate potential. Further, this invention relates to a device wherein the control of the energization of said photoflash tube may be effected either manually or automatically.

In the present type of systems using the newer kinds of gas filled photoflash bulbs, such as that sold by the General Electric Company under the trade designation of "FT 110," and further illustrated by U. S. Patent No. 2,399,222, a voltage of around 1,000 volts is placed across electrodes located at opposite ends of said bulbs. A starter electrode is wound around the tube and when a high voltage, such as 10,000 volts, is placed between the starting electrode and one of the main electrodes a spark jumps between the starting electrode and one of the main electrodes. This spark initiates ionization of the gas within the tube and this permits a flow of current between the said electrodes which current is usually stored in high capacity condensers. The large flow between the two main electrodes drains the condensers, and a current of short duration and high value causes such multiple ionization of the gas in the tube to create light of very great intensity. In said present systems, the high voltage for the starting electrode is usually developed by small pulsing transformers of a well known type and particularly such as are commonly used with model gas engines. The primary winding of this transformer is energized from the voltage across the condensers.

This circuit, however, requires three conductors going to the flash bulb. This is not only inconvenient and relatively expensive in its requirement for wire where the flash bulb is to be placed a substantial distance from the source of potential, but it also requires relatively heavy insulation of said wires in order to control the high potentials being conducted thereby.

In the present method, however, it is possible to locate the small pulsing transformer adjacent the flash bulb and only two wires are then necessary between the charged condensers and the par's immediately associated with the flash bulb. This eliminates the difficulty mentioned in the preceding paragraph and makes it feasible to use the tube at substantial distances from its source of energy.

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It thus becomes feasible to use this type of flash bulb as a signaling device having use as a distress signal for boats in open water or for aircraft subjected to forced landings.

For signaling purposes, it is desirable that the apparatus be controlled manually, if desired, and otherwise that it be capable of effecting automatic repeated flashings on an automatic control.

Accordingly, a principal object of the invention is to provide effective and simple means for energizing gas filled photoflash bulbs for extremely short periods of time.

A further object of the invention is to provide means, as aforesaid, which is relatively simple and of small volume and weight.

A further object of the invention is to provide apparatus, as aforesaid, comprised of parts of such physical size and arrangement that the photoflash bulb and any parts necessarily associated adjacent thereto can feasibly be spaced a substantial distance from the rest of the apparatus and be connected thereto by only two wires.

A further object of the invention is to provide apparatus, as aforesaid, wherein said wires carry at a relatively moderate potential and thereby eliminate the necessity of providing heavy insulation on said wires.

A further object of the invention is to provide apparatus, as aforesaid which may be readily converted from manual to automatic control and vice versa.

A further object of the invention is to provide apparatus, as aforesaid, having therein no movable parts, excepting a relay, and being of a high degree of accuracy and reliability.

Other objects and purposes of the invention will become apparent to persons acquainted with this kind of apparatus upon examination of the following specification and inspection of the accompanying drawing.

In the drawing there is shown a circuit diagram embodying and illustrating the invention.

General construction

In general, the circuit comprises a voltage doubling circuit with its output terminals connected in series to a pulse controlling capacitor and to the primary winding of a pulsing transformer. The secondary winding of said pulsing transformer is connected to the starting electrode and to one of the main electrodes of the photoflash tube. One output terminal of said voltage doubling circuit is also connected directly to said one main electrode. The other main electrode of

the photoflash tube is connected between said capacitor and the other terminal of the voltage doubling circuit. The winding of a relay solenoid, and a capacitor in parallel therewith, are interposed in series into the circuit between the transformer secondary winding and one of the main condensers in the voltage doubling circuit. The normally closed contacts of said relay are connected in series with said other terminal of the voltage doubling circuit and the pulse controlling capacitor. As the main condensers are charged, current passes through said relay winding and holds said relay open. As soon as said condensers become charged, the current ceases to pass through said winding, so that the winding becomes de-energized and the relay contacts are allowed to close, thus closing the circuit through the pulse controlling capacitor and the pulsing transformer and thereby effecting the imposition of a high potential of short duration onto the photoflash bulb.

Detailed description

Turning now to the diagram and describing the circuit in more detail, the primary winding 1 of a power transformer 2 may be supplied by any convenient source of alternating current, such as a hand or power driven generator or a battery energized vibrator supply. By a suitable step-up ratio the secondary winding 3 of said transformer is caused to provide a voltage output of the order of 500 to 1,000 volts. Any conventional voltage doubling circuit may be used to build up a charge across the main, or power, capacitors 8 and 9. In this particular instance, a first end 32 of the secondary winding 3 is connected through a rectifier 4 to one end of the relay winding 6. A capacitor 7 of suitable capacity is connected in parallel with said winding. A variable resistor 23 is also connected in parallel with said winding 6. The other end of said winding is connected to one side of the power capacitor 8 and the other side of said capacitor 8 is connected to the other end 31 of said secondary winding 3. Said other end 31 of said secondary winding is also connected through the point 30 to one side of the power capacitor 9 and the other side of said capacitor is connected through the rectifier 5 to the first end 32 of said secondary winding 3.

The voltages across the power capacitors 8 and 9 being additive, the total voltage across both capacitors is equal to about double the voltage across the secondary winding 3. The respective capacities of the capacitors 8 and 9 will govern the amount of current passing through the photoflash bulb and thus will determine the intensity of the flash.

A point 34 located between the capacitor 8 and the relay winding 6 constitutes one output terminal for the voltage doubling circuit and is connected to the main electrode 19 of the photoflash tube 18. Said output terminal is also connected to one end of the primary winding 15 of a small pulsing transformer 16, said transformer having such ratio as needed to provide on its secondary winding 17 the voltage needed to start the photoflash tube 18, such as 10,000 volts. The other end of said primary winding is connected to one side of the pulse controlling capacitor 13 and the other side of the said capacitor is connected through the manual switch 12 and the pole 36 of the two-pole selector switch 10 to the point 35, constituting the other output terminal of the voltage doubling circuit, which point is located between the power capacitor 9 and the rectifier 5.

The contacts 11 of the relay are normally closed and are located between the other pole 37 of said selector switch 10 and the capacitor 13. The location relative to each other of the primary winding 15, the capacitor 13 and the group comprising said switches and the relay contacts as here given is illustrative only for they may be placed in any order in the D. C. circuit energized by the power capacitors, provided only they remain in series circuit.

A relatively high resistance 14 is connected in parallel with the capacitor 13 for the purpose of discharging same between periods of operation. The value of said resistance will be chosen to effect said discharge within the shortest period of time desired between operations.

The starting electrode 21 of the photoflash tube 18 is connected to one end of the secondary winding 17 of the said pulsing transformer and the other end of said secondary winding is connected to the main electrode 19 of said photoflash tube. The other main electrode 20 of said photoflash tube is connected, as at the point 38, into the circuit between the capacitor 13 and the switches 11 and 12.

The part of the circuit from point 34 through winding 15, through capacitor 13 including the resistor 14, the switches and back to point 35 will sometimes be referred to as the "pulse circuit" and the part of the circuit including secondary 17 and the photoflash tube will sometimes be referred to as the "energizing circuit." The voltage doubling circuit, including the relay winding 6 and the capacitor 7 may alternatively be called the "power circuit."

Operation

With the switch 10 engaging contact 36, the unit will be manually operated.

In its at rest position, alternate energization of the secondary winding 3 will act through the rectifiers 4 and 5 to charge the capacitors 8 and 9 to the limit of their respective capacities. Then, upon closing the push button switch 12, the capacitor 13 will be charged immediately. This will effect the flow of a large number of electrons, that is, will effect a strong but brief surge of current, through the primary winding 15 of the pulsing transformer 16. With this large flow of current through said primary winding 15, a voltage of a high order, as about 10,000 volts, is effected in said secondary winding 17 and imposed between the starting electrode 21 and the main electrode 19. This voltage is great enough to cause a spark to jump the gap between said electrodes 19 and 21 and thereby start ionization of the gas within the photoflash tube and thereby allow the full current from the capacitors 8 and 9 to flow between the main electrodes 19 and 20. This will cause a very brilliant light of duration measured by the period of time required by capacitors 8 and 9 to discharge to a potential below which light is not created. This period will normally be measured in microseconds, such as approximately 200 microseconds.

In the meantime, the charge on the capacitor 13 is draining out through the resistor 14 so that by the time the apparatus is ready to initiate another flash of light, the capacitor 13 is substantially discharged and ready to repeat the operation above described.

For automatic repetitive operation, the selector switch 10 is placed in contact with the terminal 37 in the pulse circuit. With the capacitors 8 and 9 both discharged, when current first starts flowing

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from the secondary winding 3 of the transformer 2 it will flow through the relay winding 6 and thereby energize same and cause it to hold open the normally closed relay contacts 11. The capacitor 7 will hold said winding energized during the otherwise inactive half cycles. However, when the capacitor 8 becomes fully charged, or substantially so, the flow of electrons through the relay winding 6 diminishes to a sufficiently low value that said winding becomes de-energized and the contacts 11 close. This, then, effects the same sequence of operations above described as occurring when the push button switch 12 is closed and thereby causes the flash bulb to become energized.

As soon as the flow through the flash bulb 18 discharges the capacitors 8 and 9, they will again begin drawing charge from the secondary winding 3 of the transformer 2, the relay winding 6 is again energized and the contacts 11 are again opened. It will be appreciated that this process will be automatically repetitive for so long as a source of energy is provided to the primary winding 1 of the transformer 2.

The frequency at which the photoflash tube 18 will become illuminated will depend upon the resistance value of the relay coil 6, the value of the capacitor 7 and upon the selected value of the variable resistor 23. Said values may be readily chosen according to conventional practice to determine the frequencies desired.

One particular use contemplated for this circuit, which is illustrative of its utility but by no means limiting, contemplates placing the phototube 18 along with the pulsing transformer 16 and capacitor 13 and resistor 14 in suitable means to be released with a balloon from aircraft which has been subject to a forced landing. The rest of the apparatus remains on the ground for operation by any convenient means, such as a hand generator. The conductors 40 and 41 connect the ground apparatus to the apparatus which is aloft and do so by only two wires having relatively moderate potentials therein.

Thus, either an automatically or a manually flashing light of great intensity may be held aloft a substantial distance above said grounded aircraft and the work of search parties thereby greatly facilitated. When so used as a signal device to be carried aloft, it is apparent that the pulsing transformer 16, the pulse controlling capacitor 13 and the resistance 14 will all be associated closely together and in close proximity to the photoflash tube 18. Thus, means will be provided by which said parts are held in closely compact relationship so as to be readily lifted by said balloon. The broken line 45 indicates any conventional means for holding said parts in such manner.

Likewise, the parts comprising the transformer 2, the power capacitors 8 and 9, the relay and the manual control switch 12, together with the conductors and other parts associated therewith will normally be enclosed in a suitable box and arranged in closely assembled relationship with each other. The broken line 46 represents any conventional container suitable for this purpose. The conductors 40 and 41 may, in the light of the foregoing, obviously be of very great length and thereby permit the photoflash device and the means contained within the box 45 to be separated a substantial distance from the rest of the apparatus.

Alternatively, the light may be placed in a lighthouse, on a pole, on an airfield tower, or the

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whole apparatus may be consolidated into a single box where there is no need to have the light spaced any material distance from the power source.

While the foregoing specification and accompanying drawing illustrate and describe one specific embodiment of the invention, it will be apparent to those familiar with apparatus of this sort that several variations and changes in addition to those above specifically mentioned may be made therein without taking the invention out of the scope of the hereinafter appended claims except as said claims may expressly require otherwise.

I claim:

1. In an energization and timing device for a photoflash tube, the combination comprising: a source of alternating potential; means providing a voltage doubling circuit including a pair of power capacitors in series with each other and a relay winding in series with one of said capacitors; a capacitor in parallel with said relay winding; a pulsing transformer having primary and secondary windings; a relay; a pulse controlling capacitor; means connecting said pulse controlling capacitor and the primary winding of said pulsing transformer in series with each other and in series with said power capacitors, said means including the contacts of said relay; means connecting one end of the secondary winding of said pulsing transformer to one of the principal electrodes of the photoflash tube and means connecting the other end of said secondary winding to the starting electrode of said photoflash tube; and means connecting said one principal electrode also to one side of one of said power capacitors and means connecting the other of the principal electrodes of the photoflash tubes to the opposite side of the other of said power capacitors.

2. A device defined in claim 1 having also a resistor bridging said pulse capacitor.

3. An apparatus defined in claim 1 having a two pole, selector switch in series with the contacts of said relay and adjacent thereto, said relay circuit being connected to one of said two poles, and having a manually operated switch connected to the other of said poles and bridging said relay.

4. In an energization and timing device having a photoflash tube, said photoflash tube having a pair of principal electrodes and a starting electrode, the combination comprising: a source of alternating potential; means providing a voltage doubling circuit connected to said source, said means including a pair of power capacitors in series with each other and having a pair of output terminals located one on each side of the respectively remote sides of said pair of power capacitors; a relay having contacts and a relay winding, said relay winding being interposed into said voltage doubling circuit in series with one of said power capacitors, and a relay capacitor connected in parallel with said relay winding; a pair of conductors connecting said terminals with the principal electrodes of said photoflash tube, the contacts of said relay being interposed into the circuit of one of said conductors, a pulse transformer and a pulse controlling capacitor and means connecting the primary winding of said pulse transformer and said pulse controlling capacitor in series with each other and between said conductors; means connecting the secondary winding of said pulse transformer between one of said principal electrodes and said starting electrode.

5. Apparatus defined in claim 4 having a resistor bridging said pulse controlling capacitor.

6. In apparatus for energizing a load of high initial resistance and low resistance after initial resistance has been overcome, the combination comprising: a source of alternating potential; a power capacitor and means including a rectifier connecting each side of said capacitor to said source; a second power capacitor and means connecting one side thereof to a point between said first power capacitor and the side of said source connected thereto, and means including a rectifier connecting the other side of said second power capacitor to the other side of said source, said rectifier being of opposite polarity with respect to said first named rectifier; a relay having contacts and a winding; said winding being included in series between one of said power capacitors and said source; a pair of terminal points located on respectively opposite sides of said power capacitors; and a pair of conductors connecting said terminals to said load; the contacts of said relay being normally closed and being interposed into the circuit of one of said conductors.

7. In a signaling device including a photoflash tube having principal electrodes and a starting electrode, the combination defined in claim 6 together with: a pulsing transformer,

having primary and secondary windings, and a pulse controlling capacitor; means connecting the primary winding of said transformer and said pulse controlling capacitor in series with each other and between said two conductors, means connecting said two conductors to the principal electrodes of said photoflash tube and means connecting the secondary winding of said pulse transformer between one of said main electrodes and said starting electrode, said pulse transformer and said capacitor being mounted in close proximity to said photoflash tube, and said relay, said power capacitors, and the means associated directly therewith, being mounted in close proximity with said source; whereby said photoflash tube may be separated by a substantial distance from said power capacitors and said relay.

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