ELECTRONIC INTERVAL TIMER

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Filed: Apr. 28, 1969

Appl. No.: 823,237

U.S. Cl. ................................................................. 102/70.2 R
Int. Cl. ................................................................. F42c 11/06
Field of Search ..................................................... 102/70.2

ABSTRACT

An electronic interval timer for delaying ignition of the rocket motor after ejection of a weapon from an aircraft for providing a safe interval for weapon separation.

1 Claim, 5 Drawing Figures
FIG. 1.
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ELECTRONIC INTERVAL TIMER

GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for The Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

The invention relates to a free fall weapon adapted to be carried on an airframe. In carrying a weapon on an airplane, problems of separation, proper fuzing and retardation of the weapon must be recognized and solved. In the present configuration, the weapon comprises a canister having cluster bomblets therein. In the operation of the weapon, the complete weapon is dropped and the bomblets are ejected after a safe separation from the aircraft has been achieved.

One of the major problems associated in dropping of the weapon from the aircraft is not only separation from the aircraft but deploying the bomblets. A procedure tried prior to the present invention blew pieces of the free fall weapon into the drone plane upon initiation of the rocket motor which was used to eject the bomblets from the container.

Another safe-separation device tried was a magneto firer, actuated by a 20-foot lanyard. However, at high speeds the lanyard proved unreliable due to the excessive friction between the lanyard and the firer through the airframe.

SUMMARY OF THE INVENTION

The invention comprises an electronic interval timer consisting of seven capacitors, five resistors, three diodes, two transistors, two switches, and a transformer. The timing interval is 600 ± 50, −20 milliseconds. The interval timer is mounted on an aft bulkhead of the free fall weapon and is initiated upon release of the weapon from the aircraft. The interval timer also incorporates an arm and safe feature so that the safe separation timer cannot operate without being electrically charged; the MK 16 Zuni rocket motor used to eject the bomblets cannot operate without being in the arm position and the spring loaded safe and arm switch cannot open to unground the circuit as long as the arming wire is inserted.

BRIEF DESCRIPTION OF THE DRAWING:

FIG. 1 illustrates the operational sequence of the present invention;

FIG. 2 is a schematic diagram of the interval timer in the safe position;

FIG. 3 is an elevation view of the aft bulkhead upon which the interval timer is mounted;

FIG. 4 is a side elevation of the interval timer mounted on the aft bulkhead; and

FIG. 5 is another elevation view of the side opposite that shown in FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1A through 1F illustrate the drop of the free fall weapon, firing of the Zuni motor which causes the nose cone to disintegrate thereby venting the exhaust gases from the Zuni rocket motor, ejection of the bomblets and their subsequent impingement on the ground or a target.

FIG. 2 is a schematic diagram of the interval timer in the safe position, which allows separation of the weapon and subsequent ejection of the bomblets with the least probability of danger to the airframe of the aircraft carrying the weapon.

A 12 millisecond 300 volt d.c. positive pulse from the delivery aircraft is coupled to input 10 through current limiting resistor 11 and diode 12 to one side of storage capacitors 13, 14, 15, 16 and 17 connected in parallel across lines 41 and 42. The 12 millisecond 300 volt d.c. positive pulse builds up a 50 volt d.c. charge on the capacitors 13 − 17 regulated by a Zener diode 18 connected in parallel therewith. Difference in potential causes current to flow in resistor 19 and the parallel circuit comprising resistors 20, 21 and capacitor 22 which are in series and the interbase resistance of transistor 23.

When the voltage across capacitor 22 reaches the unjunction standoff ratio of the transistor 23, the transistor is enabled and capacitor 22 discharges through the emitter-base junction of transistor 23 and the primary winding 24 of transformer 25. This results in a pulse being generated in the primary winding 24.

Transformer action through secondary winding 26 causes a positive pulse to appear at the gate of SCR 29 causing it to conduct. Conduction of SCR 29 causes full potential to appear across the load at output terminals 30. This output provides a minimum of 160,000 ergs and fires an explosive charge within a piston motor 55 (shown in FIGS. 4 and 5) which requires a maximum of 43,000 ergs.

Output of the piston motor 55 provides a force of 100 lb through five-sixteenth-inch of travel. This operates a force-transmitting linkage 56 (FIGS. 3 − 5) which unlocks a cluster ring 50 (FIG. 3).

After 23 degrees of rotation, switch 32 is closed and the voltage across capacitor 19 appears across the load at output terminals 33. This provides an energy equivalent of 225,000 ergs and fires the ignitor to the MK 16 Zuni motor which requires a maximum of 100,000 ergs.

Diodes 12 and 31 are isolation diodes while the parallel combination of resistor 27 and capacitor 28 connected across the secondary winding 26 of transformer 25 prevents voltage transients from enabling SCR 29 prematurely through excessive rate of voltage change with respect to time (dv/dt) on the anode.

Safe and arm switch 34 (shown in the safe position) applies a short circuit across output terminals 33 and 30 through movable contact 35 and fixed contact 37 and movable contact 36 and fixed contact 39 respectively. Fixed contacts 38 and 40 are unconnected.

FIG. 3 illustrates the switch 34 and arming wire assembles 52 and 53 in position on the aft bulkhead of the weapon. Arming wire 52 is removed prior to the aircraft taking off and arming wire 53 is removed when the weapon is released from the aircraft.

When the piston motor 55 is fired, pawl 51 in FIG. 3 is removed from the cluster lock ring 50. The ring 50 is allowed to contract from the original position and the aft bulkhead 54 is released.

When the weapon is released, charging of the storage capacitors cannot occur until ejection takes place. This
is accompanied by having aircraft voltage present at an open switch. Ejection movement closes this switch after one inch of bomb travel and supplies 300 volts d.c. to the capacitor bank. The charging duration is 12 milliseconds which is the time for the bomb to move two inches at ejection velocity. Arming wire 53 is withdrawn to activate the interval timer by removing the short circuit across outputs 30 and 33.

Safe separation time coupled with ejection velocity insures delivery aircraft escape from particles that could be blown into the aircraft surfaces by the rocket motor, even if the canister should rupture instead of bomblet ejection occurring. As a further safety feature, the bomblets cannot arm until their arming vanes rotate at 6,000 rpm.

What is claimed is:

1. An interval timer comprising:
a first set of output terminals;
arm and safe switching means having an arm and safe position and a set of contacts for shorting out said first set of output terminals in the safe position;
the output terminals being rendered open when said arm and safe switching means is in the arm position;
voltage input means;
electrical storage means connected to said input means;
electronic switching means electrically connected to said storage means;
said electronics switching means being normally off and being switched on when the voltage across the storage means reaches a predetermined threshold value;
pulse forming means electrically connected to said electronic switching means for producing an output pulse;
another electronic switching means electrically connected to said pulse forming means and connected to apply the stored voltage across the output terminals;
said another electronic switching means being operative on receipt of said input pulse to apply the stored voltage across said first set of output terminals;
load means connected across said first set of output terminals which are initiated upon receipt of said stored voltage;
another set of output terminals;
said arm and safe switching means having another set of contacts for shorting out said another set of output terminals in the safe position;
said another set of output terminals being rendered open when the arm and safe switching means is in the arm position;
said another switching means electrically connected to said another set of output terminals to apply said stored voltage across said another set of output terminals when said another switching means is in a closed position;
said load means connected across said one set of output terminals being operative to cause said another switching means to close upon initiation of said load means.

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