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[54] **MISSILE DESTRUCT INITIATION ASSEMBLY**
9 Claims, 1 Drawing Fig.

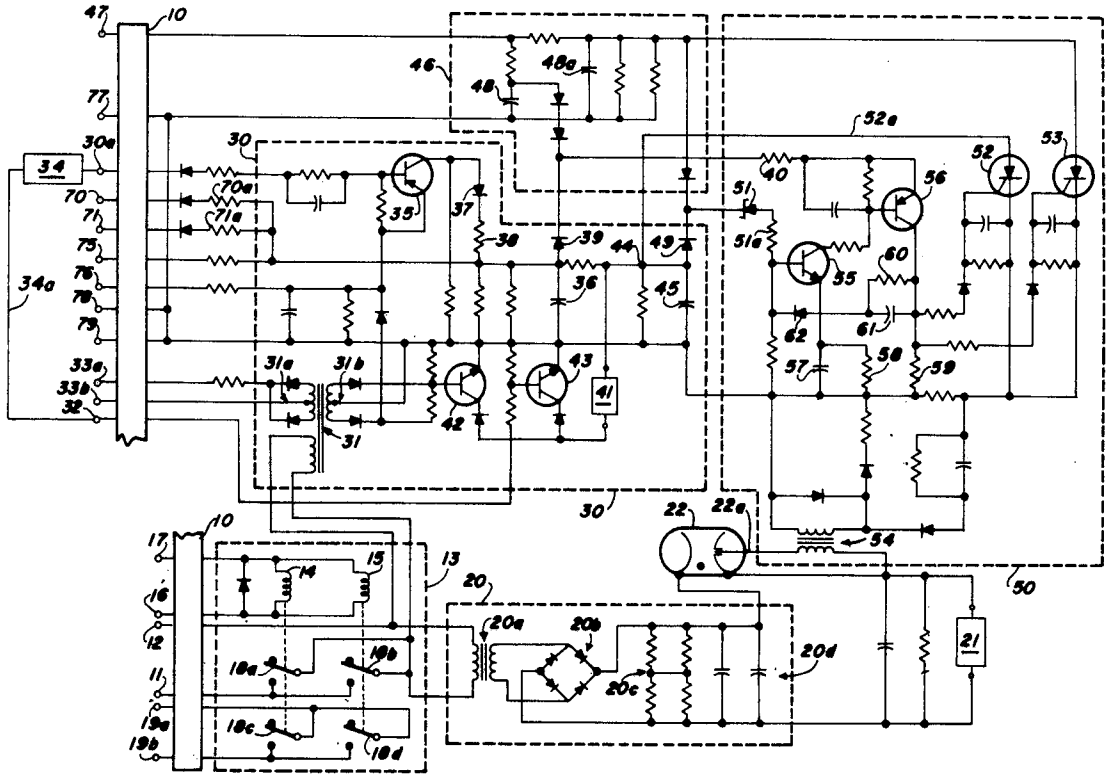
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[50] Field of Search 102/70.2

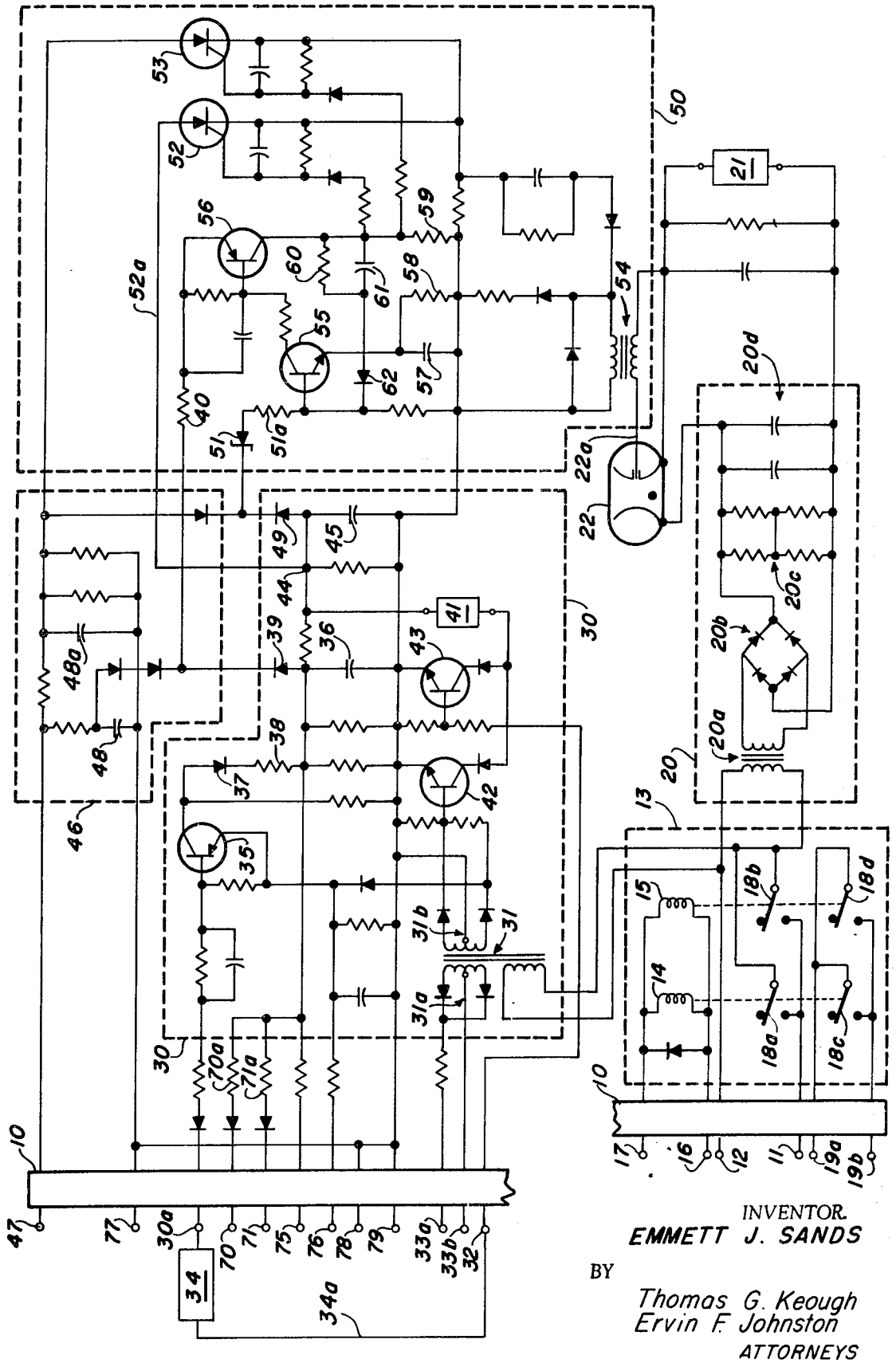
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ABSTRACT: A missile destruct initiation assembly is provided that interconnects a detonator to a high-current source and contains a command destruct circuit for passing a command destruct signal to initiate detonation, and an autodestruct circuit responsive to an autodestruct signal, representative of internal missile malfunction to initiate the detonator. Thus, the assembly for initiating missile destruction performs the dual function of being responsive to a command destruct source or an autodestruct source.





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MISSILE DESTRUCT INITIATION ASSEMBLY

STATEMENT OF 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 therefore.

BACKGROUND OF THE INVENTION

For reasons of safety, missiles are conventionally provided with destruct circuits to inhibit the destruction of the missile during launch, or thereafter, in the event that the missile malfunctions or goes past its intended target, to enable its destruction. Contemporary circuits initiated after a predetermined time, or upon malfunction, are usually separate and distinct from a circuit that is initiated by a remotely originating command signal largely because a timed or autodestruct signal and a remotely originating command signal are usually of vastly different magnitudes and, when handled by the same circuitry, fail to initiate detonation. Providing separate circuits ensures more reliable detonation but results in a duplication of many circuit components. This unnecessary duplication means increased weight and is prohibitive on relatively lightweight air-to-air missiles or crew-served antitank missiles. A compact, dual-function destruct initiation assembly remains a desired feature in current, tactical missiles.

SUMMARY OF THE INVENTION

The present invention is directed to providing a missile destruct initiation assembly including a potential source connected to a detonator by a gap switch. A command destruct circuit, passing a command destruct signal, is paralleled by an autodestruct circuit, responsive to a signal representative, for example, of a missile acceleration. Both circuits are connected to a destruct trigger circuit that drives the gas-filled gap switch. Substantially, complete reliability is provided in the autodestruct circuit by including a clamping means holding the destruct trigger circuit below the critical magnitude required for initiating the gap switch. Paralleling the autodestruct circuit, an autodestruct inhibit circuit actuates the clamping means to ensure nondestruct operation of the circuit prior to the point in time when the autodestruct circuit passes an arming signal.

Therefore, it is an object of the instant invention to provide a destruct initiation assembly of greater safety.

A further object is to provide an initiation assembly possessing a dual-function capability.

Yet another object is to provide a destruct initiation assembly incapable of initiation of a detonator until a predetermined acceleration is reached.

Yet another object is to provide an assembly responsive to dual-function signals and having common circuitry.

An ultimate object of the instant invention is to provide a missile destruct initiation assembly of high reliability and safety by having a minimal amount of components.

BRIEF DESCRIPTION OF THE DRAWING

The FIGURE depicts the schematic diagram of the preferred form of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing, the missile destruct initiation assembly is depicted as terminating in a common control panel **10**, although operatively employed, the assembly's input and output terminals are arranged in a missile housing as convenience and configuration permit. An external source of AC arming potential is connected across terminals **11** and **12** and is coupled to following circuitry when a pair of coils **14** and **15** are energized by an externally originating arm control signal impressed across terminals **16** and **17**. In a representative utilization, the arm control signal across terminals **16** and **17** is the signal transferred to the missile when the missile is switched to the "off safe" condition prior to launch or after launch during the missile's first motion.

Coils **14** and **15** displace a plurality of relay contacts **18*a***, **18*b***, **18*c***, and **18*d*** to transfer the AC arming voltage to following circuitry. Switches **18*a*** and **18*b***, connected in parallel for reliability, cooperate to pass AC potential to a source of high DC current **20**. The source is formed of a power supply transformer **20*a***, full-wave rectifier **20*b***, load resistors **20*c***, and high-current storage capacitors **20*d*** functioning in an obvious manner to provide a burst of high DC current across a gap switch **22** to a detonator **21**. The gap switch is a gas-filled tube, viz a thyratron-type tube, serially joining the current source and the detonator via its cathode and anode. The potential maintained across the gap switch is insufficient to cause conduction by itself, but conduction occurs between the anode and cathode when grid **22*a*** receives a signal that initiates ionization of gas.

When an arm control signal is impressed across terminals **16** and **17**, the coils displace the relay contacts **18*c*** and **18*b*** to transfer an ignition arm control signal to terminals **19*a*** and **19*b*** or give a visual representation of the circuit's actuation at a remotely located readout.

Aside from providing the high DC circuit, the AC arming potential impressed across terminals **11** and **12** is fed to an autodestruct circuit **30** via a power supply transformer **31**. The autodestruct circuit functions to initiate detonation when some missile malfunction occurs or after a predetermined time has elapsed, indicating that the missile has missed its intended target. However, prior to launch, but subsequent to the missile destruct initiation assembly's receiving the arm control signal, the autodestruct circuit is inhibited by an autodestruct inhibit input at terminal **32**. The autodestruct inhibit input is also derived from the AC arming potential through a first power supply transformer secondary **31*a*** terminating in terminal points **33*a*** and **33*b*** externally feeding the signal to terminal **32**. As the AC arming potential activates the destruct initiation assembly and prior to launch, the autodestruct inhibit input is fed from terminal **32** to the base of transistor **43** for clamping certain following elements, the purpose of which will be set out below.

The autodestruct circuit is actuated to permit the generation of an autodestruct signal when a remotely located accelerometer **34** impresses an arm control signal function upon an autodestruct input terminal **30*a***. The arm control signal function input is produced as a function of missile acceleration. That is to say, as the relative acceleration of the missile reaches a predetermined value representing a safe separation of the missile from the launcher, the arm control signal function is generated in the accelerometer and is passed to the autodestruct circuit to ensure its self-generation of an autodestruct signal. Simultaneously, the accelerometer passes a nullifying signal on lead **34*a*** to autodestruct inhibit input terminal **32** to remove the autodestruct inhibit signal appearing there.

Within the autodestruct circuit, a second power supply transformer secondary **31*b*** derives a biasing potential fed to transistor **35**. This biasing potential impressed across transistor **35** is of insufficient magnitude to initiate conduction by itself. However, as the autodestruct arm control signal is fed to the base of the transistor from input terminal **30*a***, conduction occurs and then an autodestruct signal is generated on an interconnected capacitor **36**. The generated autodestruct signal is blocked from a following destruct trigger circuit **50** because transistor **43** maintains a clamp potential of approximately 1 volt at point **44**, which potential is held across a second storage means, capacitor **45**. The clamping potential is ensured after removal of the autodestruct inhibit input signal to hold transistor **43** in conduction by feeding a positive control signal to the base of the transistor **42** derived from the second power supply transformer secondary **31*b***.

Spurious signals are prevented from entering and actuating destruct trigger circuit **50** by serially interposing a back-biased, Zener diode **51** that blocks low-magnitude signals from entering the destruct trigger circuit.

The command destruct circuit **46** is provided for passing remotely originating command destruct signals to the destruct trigger circuit when monitoring personnel seek to destroy the missile for purposes of safety or for missile effectiveness. A command destruct signal fed to terminal **47** also is of a magnitude in excess of the back-biasing potential required to break down back-biasing, Zener diode **51** and to initiate conduction through the destruct trigger circuit.

Initiation of the destruct trigger circuit hinges on supplying biasing potentials to the anode of either silicon-controlled rectifiers **52** or **53**, and, simultaneously generating, within the destruct trigger circuit, a gating potential sufficient to break down either of the SCR's and cause conduction.

When conduction occurs, a burst of energy is fed to the primary of a trigger circuit coupling transformer **54**. The secondary of the transformer is connected to the grid **22***a* of the gap switch which ionizes the gas to create a conductive path for the high DC current to the detonator.

The electronic coaction and the operation of the above referred to circuit will become more apparent by following the sequence occurring when either a command destruct signal or an autodestruct signal is fed to the gap switch.

Upon supplying the AC arming voltage to the complete destruct initiation assembly via impressing an arm control signal across terminals **16** and **17**, power supply transformer **20***a* provides the high source of DC current while power supply transformer **31** supplies biasing potential to the autodestruct circuit **30**, as well as providing an autodestruct inhibit input signal at autodestruct inhibit input terminal **32**. The high-current storage capacitors **20***d* are charged to a magnitude approaching 2,400 volts DC and the entire destruct initiation assembly is now armed, but will not fire the detonator until a command destruct signal or an autodestruct signal is received.

When the command destruct signal is fed to terminal **47**, the anode circuit of SCR **53** is energized. The command destruct signal, having passed through Zener diode **51**, also provides a signal input to the base of transistor **55**. Charging the command destruct signal on capacitors **48** and **48***a* supplies biasing potential for transistor **55** as well as for a transistor **56**. As the command destruct signal is first fed to the transistor **55** base circuit as a step signal, capacitor **57** acts as a short circuit and shunts a resistor **58**. Transistor **56** collector current raises the potential across a resistor **59** and provides gate voltages for the SCR's **52** and **53**. The collector current also feeds a feedback potential back to the base of transistor **55** via a resistor **60**, capacitor **61**, and diode **62**. As capacitor **57** is charged by the transistor **55** emitter current, transistor **55** emitter voltage is increased. After capacitor **57** charges, approximately 1 volt DC is required at the base of transistor **55** to hold it in the conducting condition. A feedback voltage from transistor **56** clamps transistor **55** into conducting condition momentarily. Transistor **56** is driven into conduction when about 28 volts appear across resistor **59**. The energy stored at the anode of SCR **53** is conducted to the primary of trigger circuit coupling transformer **54**. The large output pulse having a very fast rise time is produced across the secondary of transformer **54** and is fed to the grid **22***a* to cause ionization of the gas within gap switch **22**. An output pulse of about 2,000 amperes is transferred to the detonator to initiate detonation.

Prior to launch, upon impressing an arm control signal across terminals **16** and **17**, the autodestruct circuit is energized through transformer **31** via a first and second power supply transformer secondary **31***a* and **31***b* and receives full wave rectified power across the autodestruct inhibit output **33***a* and **33***b*, and receives biasing potentials for its transistors **35**, **42**, and **43**. The autodestruct inhibit output appearing across terminals **33***a* and **33***b*, full-wave rectified power, is fed to autodestruct inhibit input terminal **32** and to the base of transistor **43** to drive it in conduction and to maintain a low-potential clamp on capacitor **45**.

The rectified output from second power supply transformer secondary **31***b*, providing biasing potential for transistor **35**, also holds transistor **42** in the conducting condition to provide a low-potential clamp on capacitor **45** when the autodestruct inhibit input signal is removed from the base of transistor **43**. Thusly biased, transistor **35** is nonconducting and the autodestruct circuit is considered not armed at this point.

A signal originating from accelerometer **34**, indicative of the launched missiles having attained a predetermined acceleration, "turns on" transistor **35**. Transistor **35** collector current charges an autodestruct signal on capacitor **36** through diode **37** and resistor **38**. Since the transistors **42** and **43** are both conducting, an accumulated signal on capacitor **45** is still clamped to a low potential by reason of the current flowing through transistors **42** and **43**. A supply potential for transistors **55** and **56** is provided from the charge on capacitor **36** fed through the path including diode **39** and resistor **40**. However, no current flows from the transistors **55** and **56** in the absence of transferring the autodestruct signal stored on capacitor **36** to the base of transistor **55**. Thus, the autodestruct circuit is armed with transistors **35**, **42**, and **43** conducting, and with autodestruct signal of approximately 39 volts DC, for example, charged on capacitor **36**.

In the event of missile malfunction, such as a defect in a missile's motor or an improper guidance or firing sequence arises, a circuit interrupter switch **41** interconnected in the collector circuits of transistors **42** and **43** breaks open. The interrupter switch can be a timed break relay or merely consist of a heat-, pressure-, or vibration-responsive break relay strategically located in the missile to interrupt the supply potential of transistors **42** and **43**.

With the supply potential holding transistors **42** and **43** in conduction removed via opening of the interrupter switch, the clamp on capacitor **45** is removed. Capacitor **45** is charged with the autodestruct signal stored on capacitor **36** and the anode circuit of SCR **52** is forward biased through lead **52***a*. Simultaneously, the autodestruct signal is fed to the base of transistor **55** via diode **49**, Zener diode **51**, and resistor **51***a* to drive transistors **55** and **56** into conduction according to the same electronic cooperation occurring when the command destruct signal is fed to destruct trigger circuit **50**.

The only exception between the operation of the trigger circuit when receiving an autodestruct signal or a command destruct signal, arises from the fact that, upon receiving an autodestruct signal, the gating signal delivered to the gates of both SCR's causes the forward biased SCR **52** to conduct and pass an ionizing pulse to transformer **54**, whereas, when a command destruct signal is coupled to the destruct trigger circuit, SCR **53** is forward biased and the gating signal, fed to both gates, actuates only SCR **53** to pass the ionizing pulse to transformer **54**.

When the autodestruct circuit initiates detonation of detonator **21**, a series of autodestruct signals are passed to the detonator via the trigger circuit, since transistor **35** continues to charge capacitor **36** which, in turn, feeds the charged autodestruct signal to capacitor **45** and onto the destruct trigger circuit. The series of autodestruct signals are desirable to ensure detonation.

Included in the instant assembly are two inhibit functions, an autodestruct safe command function **70** and a destruct acceleration switch inhibit function **71**, provided to prevent the charging of capacitor **36**, while the missile is on the launch pad, or while traveling the length of the launch tube prior to reaching a magnitude of acceleration required to generate the autodestruct arm control signal in accelerometer **34**. Prior to launch, the autodestruct safe command function grounds capacitor **36** through safe/arm relays in an external interlock and the destruct acceleration switch assembly when the acceleration level is below the critical magnitude. As long as either or both of the inhibit functions are actuated, capacitor **36** is grounded through resistors **70***a* or **71***a* and the voltage across capacitor **36** remains too low to permit operation of the circuits associated with transistors **55**, **56**, SCR **52** and SCR **53**.

Terminals are optionally provided for feeding monitoring signals to a visual readout display and, in the preferred em-

bodiment, provide a readout for an autodestruct power indicator at terminal **75** and for an autodestruct power indicator at terminal **76**. A return terminal **77** for the command destruct circuit **46** may be provided as well as an autodestruct arm control function return terminal **78** and an autodestruct inhibit input terminal **79** to complete the above described circuits.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings, and, it is therefore understood that within the scope of the disclosed inventive concept, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. In a missile destruct initiation assembly including a potential source connected to a detonator by a gap switch, an improvement therefore is provided comprising:

a command destruct circuit configured for passing a command destruct signal;

means for producing a signal representative of missile acceleration;

an autodestruct circuit responsive to the acceleration signal including,

means for generating an autodestruct signal as said acceleration signal reaches a predetermined magnitude,

first means coupled to the generating means for storing said autodestruct signal,

second means for storing said autodestruct signal,

clamping means in operative connection with the second storage means for impressing a hold signal, having a lesser magnitude than said autodestruct signal, thereon, and

means coupling the first and second storage means for transferring said autodestruct signal therebetween upon disruption of said operative connection; and

a destruct trigger circuit connecting said command destruct circuit and said second storage means to said gap switch to initiate said detonator upon receiving either one of the destruct signals.

2. An assembly according to claim **1** further including:

interrupter means included in said clamping means for ensuring said disruption of said operative connection upon missile malfunction.

3. An assembly according to claim **2** further including:

inhibiting means connected to said clamping means to ensure said hold signal prior to receiving said acceleration signal at said predetermined magnitude in said autodestruct circuit.

4. An assembly according to claim **3** in which said potential source provides a biasing source to said assembly and a high current source to initiate said detonator upon ionization of said gap switch when receiving either one of said destruct signals.

5. An assembly according to claim **4** further including:

an interlock simultaneously activating said biasing source, said high-current source, and said inhibiting means upon being actuated to arm said missile prior to launch and, optionally, after launch first motion.

6. An assembly according to claim **1** in which said destruct trigger circuit includes a first SCR interconnected to derive biasing and gate potentials from said command destruct signal and a second SCR interconnected to derive biasing and gate potentials from said autodestruct signal.

7. An assembly according to claim **6** in which said destruct trigger circuit includes means for passing only those said destruct signals above a trigger threshold and to inhibit the deriving of said gate potentials for both SCR's when said destruct signals are below said trigger threshold.

8. An assembly according to claim **7** in which said destruct trigger circuit includes a plurality of interconnected SCR's and transistors for ensuring said gate potentials of the proper magnitude.

9. An assembly according to claim **2** in which said interrupter means initiates a repetitive said autodestruct signal for ensuring conduction in said gap switch and initiation of said detonator.

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