

[54] RAIN IMPACT SENSING PROXIMITY FUZE

[75] Inventors: David Williams, Bethesda; George K. Lucey, Jr., Silver Spring, both of Md.

[73] Assignee: The United States of America as represented by the Secretary of the Army, Washington, D.C.

[22] Filed: Oct. 30, 1970

[21] Appl. No.: 90,211

[52] U.S. Cl. 102/70.2 P; 102/70.2 R; 102/70.2 GA

[51] Int. Cl.² F42C 13/00; F42C 11/02

[58] Field of Search.... 102/70.2 P, 70.2 R, 70.2 GA

[56] References Cited

UNITED STATES PATENTS

3,282,211	11/1966	Winston	102/70.2 R
3,419,861	12/1968	Resnick et al.	102/70.2 R
3,540,377	11/1970	Juliano et al.	102/70.2 R

Primary Examiner—Samuel Feinberg

Assistant Examiner—C. T. Jordan

Attorney, Agent, or Firm—Nathan Edelberg; Robert P. Gibson; Saul Elbaum

[57] ABSTRACT

Apparatus for momentarily desensitizing a proximity fuze in response to an impact with a raindrop. A rain impact sensor located in the nose cone of the fuze generates an electronic cut-off signal when the fuze hits a raindrop while in flight. The impact with the raindrop may also generate a spurious firing signal which can cause the firing circuit of the fuze to pre-function. The cut-off signal generated by the rain impact sensor is amplified, stretched and delivered to the firing circuit to effectively blank out any spurious firing signal received therein. The rain impact sensor may be embodied by a piezoelectric crystal mounted in the nose cone of the fuze, or a mechanical switch for sensing the shock wave generated by the impact of the raindrop, or a capacitive measuring bridge circuit that becomes unbalanced in response to the impact of the raindrop. The spurious firing signal is delayed before it reaches the firing circuit in order that the cut-off signal generated by the rain impact sensor will reach the firing circuit prior to any such spurious firing signal.

7 Claims, 2 Drawing Figures

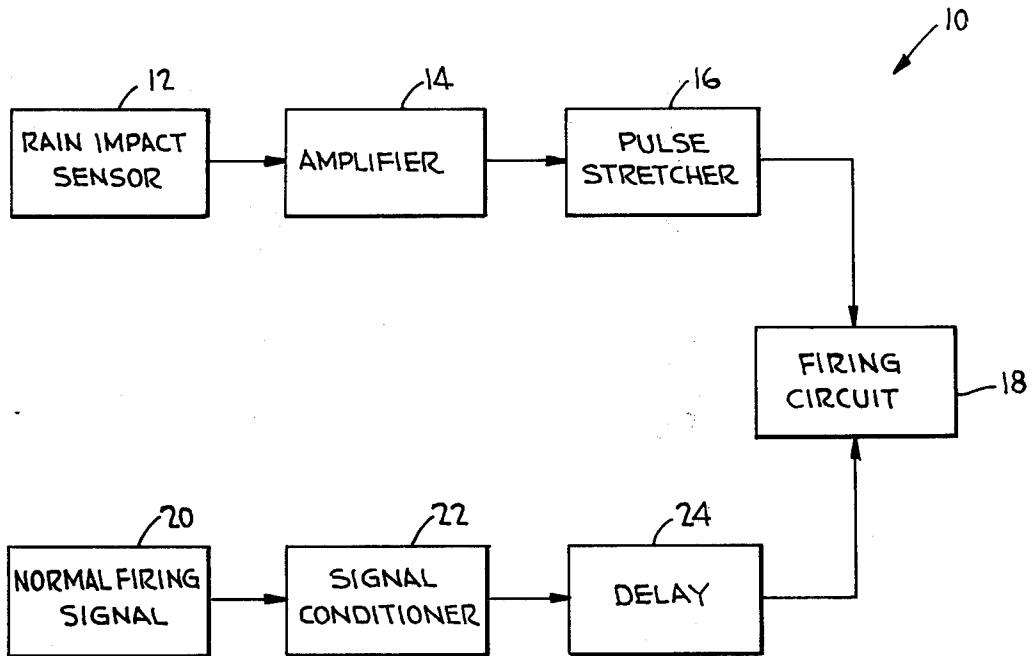


FIG. 1

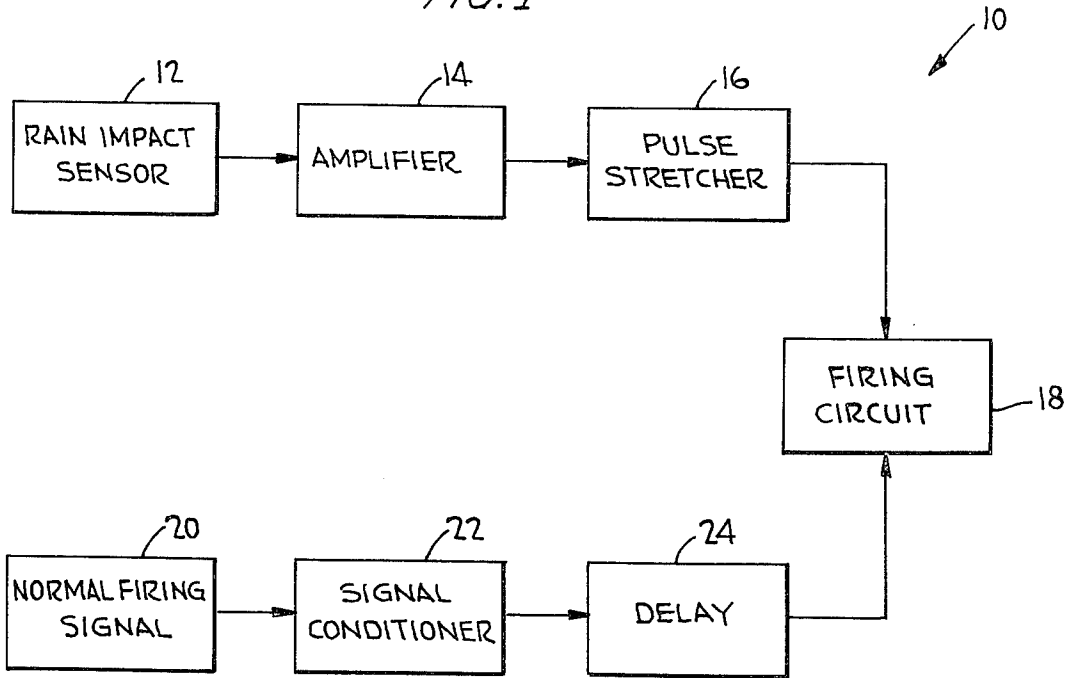
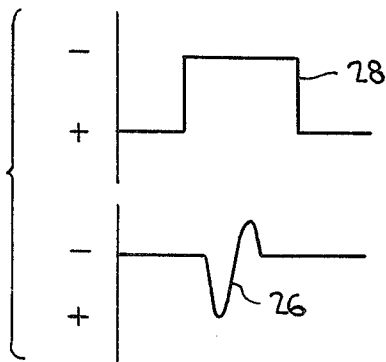


FIG. 2



INVENTORS,
DAVID WILLIAMS
GEORGE K. LUCEY, JR.
BY Harry M. Saragovitz
Edward J. Kelly
Herbert Perl
Saul Elbaum ATTORNEYS

RAIN IMPACT SENSING PROXIMITY FUZE

RIGHTS OF GOVERNMENT

The invention described herein may be manufactured, used, and licensed by or for the United States Government for governmental purposes without the payment to us of any royalty thereon.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to proximity fuzes and, more particularly, to an arrangement within a proximity fuze for negating the effects of spurious firing signals caused by impacts with raindrops while in flight.

2. Description of the Prior Art

The reliability of many low cost, proximity fuzes decreases in the presence of rain. Fuzes will occasionally prefunction because of the electrical and/or mechanical effects of an impact with a raindrop. For example, a loop fuze hitting a high dielectric raindrop will shift frequency momentarily and may produce a firing signal. Additionally, the mechanical impact may involve more than 100 g forces, thereby causing microphonism from which firing pulses may be generated. Certain types of fuzes may also be prefunctioned if they impact with charged raindrops. Previous attempts to minimize these effects have been largely unsuccessful due to the high cost and complexity of incorporating the necessary circuitry with existing fuze designs.

It is, therefore, a primary object of the present invention to provide a rain impact sensing proximity fuze that minimizes the electrical and/or mechanical effects of a fuze hitting a raindrop.

It is another object to provide a simple and low-cost arrangement within a proximity fuze for negating the effect of spurious firing signals in the fuze caused by impacts with raindrops while in flight.

A further object of the present invention is to provide a simple, low-cost arrangement for momentarily desensitizing a proximity fuze upon impact with a raindrop that is easily incorporated into existing fuzes.

An additional object of the present invention is to provide a proximity fuze designed for optimum fair weather performance that contains a rain impact inhibitor that does not affect normal fuze operation.

SUMMARY OF THE INVENTION

Briefly, in accordance with the invention, a rain impact sensing proximity fuze is provided for momentarily inhibiting spurious firing signals caused by the impact of the fuze with raindrops. The arrangement comprises a rain impact sensor that generates an electronic cut-off signal in response to the impact of the fuze with the raindrop, an amplifier and pulse stretcher for delivering an extended cut-off signal to the fuze firing circuit to render it insensitive to spurious firing signals that may have been generated by the impact with the raindrop.

BRIEF DESCRIPTION OF THE DRAWINGS

The specific nature of the invention as well as other objects, aspects, uses, and advantages thereof will clearly appear from the following description and from the accompanying drawings, in which:

FIG. 1 is a block diagram of a circuit arrangement embodying the present invention; and

FIG. 2 illustrates typical wave forms generated in the circuit of FIG. 1 in accordance with the teachings of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, the rain impact sensing proximity fuze of the present invention is illustrated generally at 10. During normal operation a firing signal is generated at 20 when the fuze approaches a predetermined distance from the target. Such a firing signal is sensed by signal conditioner 22 to ensure that it is of the proper band width and frequency. A small delay 24 is provided in the firing signal path prior to its receipt in the firing circuit 18. Upon the receipt of a proper firing signal, firing circuit 18 initiates a detonator to function the explosive in the fuze. As hereinbefore described, when a raindrop or a series of raindrops strikes the fuze while in flight, a spurious firing signal may be generated at 20 and may possibly be passed through signal conditioner 22 and delay 24 to firing circuit 18 and, if it be of sufficient duration and amplitude, will cause a prefunction of the fuze. Negating the effect of such spurious firing signals is a rain impact sensor 12 that generates an electronic cut-off signal in response to the impact of the fuze with the raindrop. The cut-off signal generated thereby is passed through an amplifier 14 and a pulse stretcher 16 to firing circuit 18. The receipt in firing circuit 18 of the amplified and stretched cut-off signal momentarily desensitizes firing circuit 18 so that any spurious firing signal generated at 20 will have no effect upon the firing circuit.

A typical desensitizing situation that occurs within firing circuit 18 is illustrated in FIG. 2 in which wave form 26 represents a spurious rain pulse firing signal that was generated at 20 upon the impact of the nose cone of the fuze with a raindrop and was passed through signal conditioner 22 and delay 24 to firing circuit 18. The same raindrop activated rain impact sensor 12, which, for example, can be a piezoelectric crystal, and produced a cut-off signal that was amplified by amplifier 14 and lengthened by pulse stretcher 16 before being fed to the gate circuit of the firing SCR within firing circuit 18. The cut-off signal 28 is seen to have blanked out the effect of rain pulse firing signal 26 within firing circuit 18. It is seen that rain impact sensor 12 can sense abnormal flight conditions and desensitize the fuze before the firing circuit is affected by the spurious firing signal due to the delay 24 in the normal firing signal path. Normal fuze action is restored after several milliseconds and the remainder of fuze operation is as if no rain were present.

Rain impact sensor 12 may also be a quick acting, very sensitive mechanical switch mounted on or near the nose cone of the fuze so that the shock wave generated by the impact of the raindrop is sensed prior to attenuation. Such a switch would initiate an electronic circuit that blanks firing circuit 18 for a predetermined time interval. Rain impact sensor 12 may also take the form of a capacitive measuring bridge circuit that becomes unbalanced in response to the impact of the nose cone of the fuze with a raindrop impacting near the sensor. A normal proximity firing signal will not be inhibited in the presence of rain since the rain impact sensor generates a cut-off signal of limited duration and only upon the impact of the fuze with a raindrop, which at most can be a periodic but not continuous action. This approach to reducing the effects of

3

rain is seen to be simple, low cost, and easily incorporated into existing fuze designs, having no effect on normal fuze operation.

We wish it to be understood that we do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

We claim as our invention:

- 1. A rain impact sensing proximity fuze, comprising:
 - a. a firing circuit that initiates the detonation of said fuze;
 - b. proximity sensing means for delivering a firing signal to said firing circuit; and
 - c. rain impact sensing means for momentarily desensitizing said firing circuit against unwanted firing signals generated by said proximity sensing means upon the impact of a raindrop with said fuze.
- 2. The invention according to claim 1, wherein said rain impact sensing means comprises:
 - a. a rain impact sensor for generating an electrical cut-off signal in response to the impact of said fuze with a raindrop; and
 - b. means for conditioning said electrical cut-off signal received from said rain impact sensor and for delivering a momentary inhibit signal to said firing

4

circuit that renders said firing circuit inoperative whereby any firing signal generated in response to the impact with the rain will be prevented from activating said firing circuit.

3. The invention according to claim 2 wherein said proximity sensing means includes means for delaying the receipt of said firing signal by said firing circuit whereby said momentary inhibit signal reaches said firing circuit prior to the receipt therein of a firing signal.

4. The invention according to claim 3 wherein said conditioning means includes an amplifier and a pulse stretcher.

5. The invention according to claim 3 wherein said rain impact sensor comprises a piezoelectric crystal mounted on the nose cone of said fuze.

6. The invention according to claim 3 wherein said rain impact sensor comprises a mechanical switch for sensing the shock wave generated by the impact of said raindrop.

7. The invention according to claim 3 wherein said rain impact sensor comprises a capacitive measuring bridge circuit that becomes unbalanced in response to the impact of said raindrop.

* * * * *

30

35

40

45

50

55

60

65