United States Patent

[11] 3,575,114

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[21] Appl. No. **753,260**
[22] Filed **Aug. 16, 1968**
[45] Patented **Apr. 13, 1971**
[73] Assignee **The United States of America, as represented by the Secretary of the Navy.**

[54] **TIME DELAY ANTI-DISTURBANCE FAZE**
7 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **102/70.2**
[51] **Int. Cl.** **F42c 11/06**
[50] **Field of Search** 102/82; 102/70.2, 71; 307/293, 273, 301

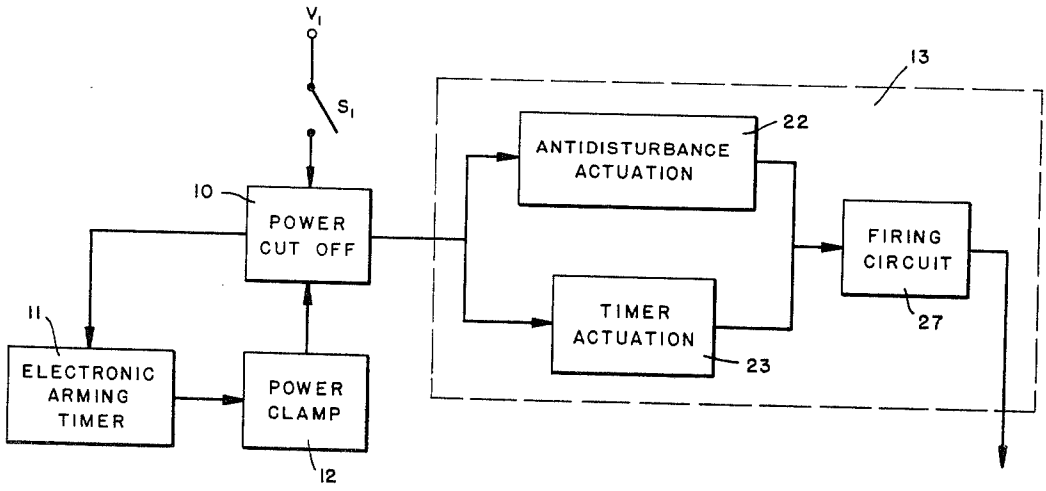
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ABSTRACT: A fuze having an electronic arming delay timer, an antidisturbance firing mechanism, and a mechanical clock timer to detonate the fuze after a prescribed period of time if the antidisturbance firing mechanism is not actuated.



2 Sheets-Sheet 1

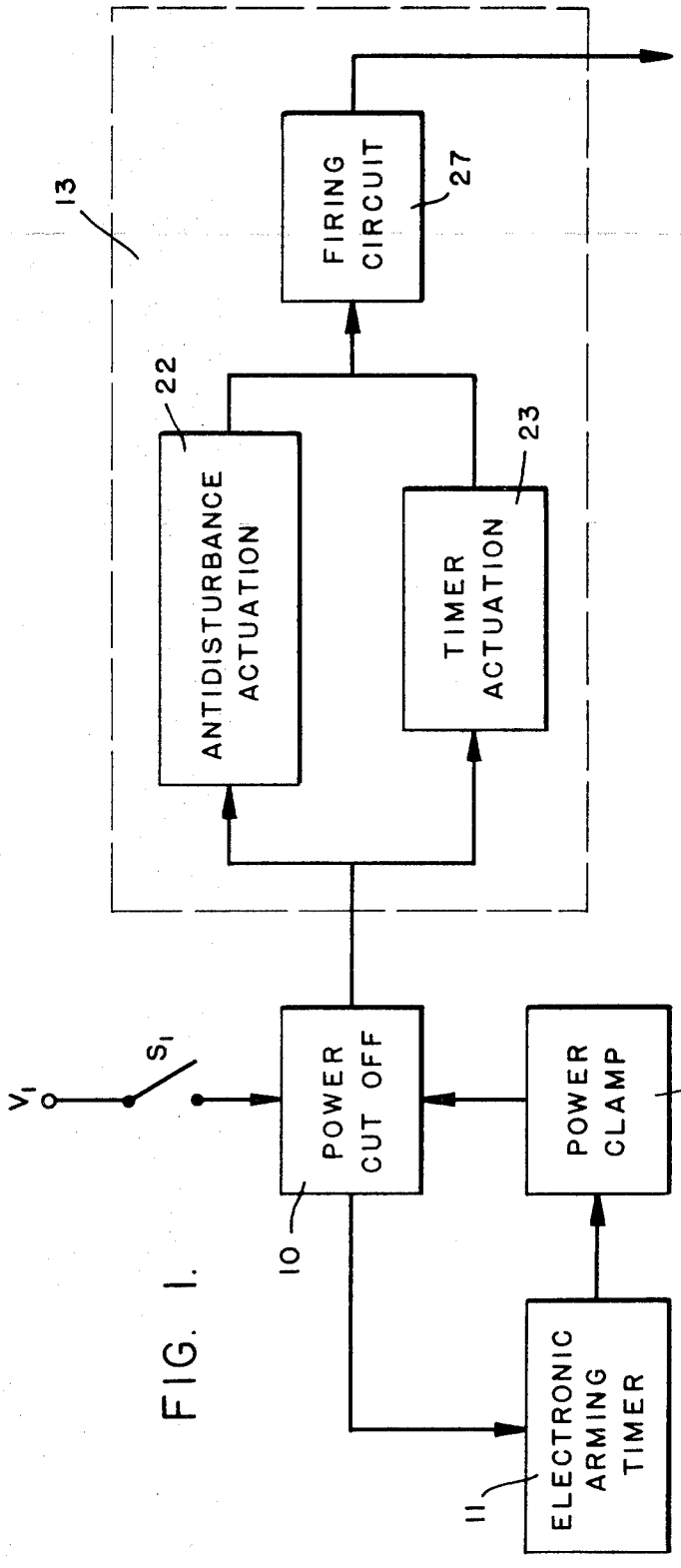


FIG. 1.

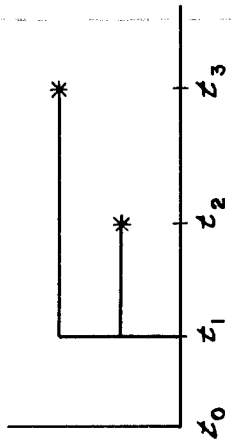
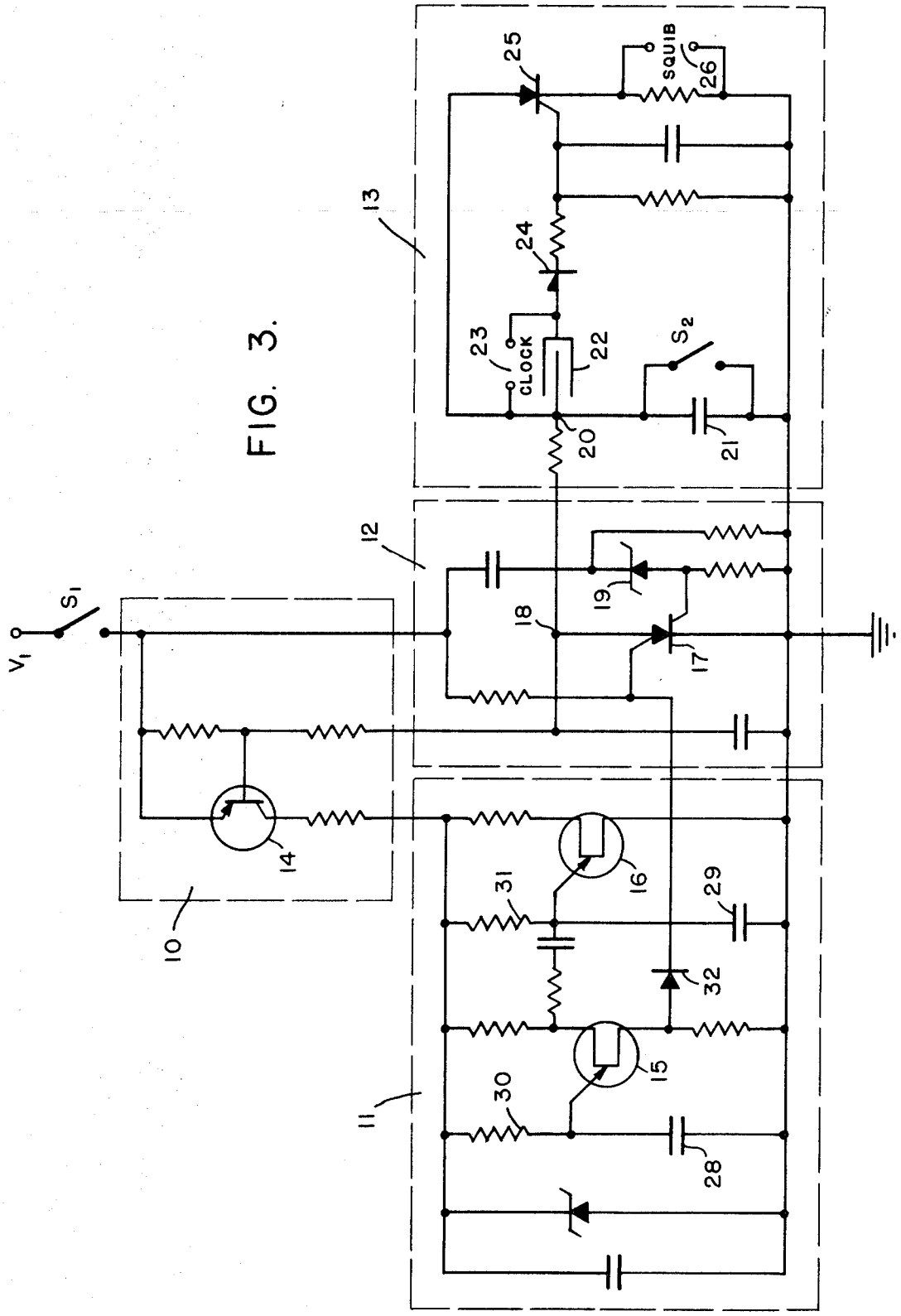


FIG. 2.

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FIG. 3.


SQUIB
25
26
13
24
23
CLOCK
22
S2
20
21
12
19
18
17
V1
S1
14
16
31
29
32
15
30
28
11
10

TIME DELAY ANTI-DISTURBANCE FAZE

BACKGROUND OF THE INVENTION

It is desirable to have a fuze that can not detonate during handling, and once armed, is not capable of being disarmed.

Such a fuze should additionally provide a safety feature which would delay arming for a preselected period of time after the means for arming are initiated. After arming is achieved, the fuse should detonate if an attempt to move it is made prior to the prescribed detonation time.

SUMMARY OF THE INVENTION

In accordance with the present invention, an electronic timer in the form of a dual unijunction relaxation oscillator is initiated. At the conclusion of the timing cycle, the dual unijunction timer triggers a silicon-controlled switch which removes a shunt placed across a firing capacitor and simultaneously turns off a transistor switch. The transistor switch prevents further current drain by the arming timer.

The firing capacitor is now permitted to charge, and when it becomes sufficiently charged, the fuze is armed and ready for detonation.

Detonation will occur in response to the movement of the trembler switch.

A mechanical clock having a time constant considerably longer than the time constant of the dual unijunction relaxation oscillator is started simultaneously with the unijunction oscillator. The clock has contacts which close upon completion of its cycle. These contacts are placed in parallel with the trembler switch so that the clock will cause detonation at the end of its cycle.

In response to the trembler switch or the clock, the firing capacitor triggers a silicon-controlled rectifier which applies the charge on the firing capacitor to a squib to cause detonation.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a block diagram of the system;

FIG. 2 is a "time-line" of the operation of the system shown in FIG. 1; and

FIG. 3 is a schematic diagram of the electronic circuitry of the system of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, upon closing of switch S_1 an electronic arming timer **11** and timer **23**, which may be a mechanical clock, being their timing cycles at time t_0 as shown in FIG. 2.

During the time interval from t_0 until t_1 power cutoff **10** supplies power to timer **11**, and power clamp **12** prevents accidental detonation by circuit **13**.

At time t_1 timer **11** triggers power clamp **12**, which in turn causes power cutoff **10** to prevent further current from voltage source V_1 to flow to timer **11** and arms circuit **13** to permit detonation.

Timer actuation **23**, which may be a mechanical clock, is set to cause detonation via firing circuit **27** at a prescribed time, t_3, occurring after time t_0. If the fuze is distributed during the time interval from t_1 until t_3 an antidisturbance actuation means, which may be a trembler switch, will cause detonation via firing circuit **27** at time t_2.

FIG. 3 is a schematic diagram of the system just prior to time t_0. For the sake of safety, switch S_2 remains closed until just prior to time t_0.

To initiate the arming cycle, switch S_1 is closed at time t_0. Silicon-controlled switch **17** is turned on bringing point **18** to ground. Thus, during the arming cycle point **20** is held at ground potential to prevent charging of firing capacitor **21** and accidental detonation. As point **18** is brought to ground, transistor switch **14** is turned on.

When switch S_1 is closed, therefore, current flows from voltage source V_1 through transistor switch **14** to dual unijunction transistor timer **11**. Timer **11** comprises a first unijunction transister relaxation oscillator consisting of unijunction transistor **16**, resistor **31** and capacitor **29**; and a second unijunction transistor relaxation oscillator consisting of unijunction transistor **15**, resistor **30** and capacitor **28**. Unijunction transistor **16** is necessary to achieve a predetermined, long time delay in the second unijunction transistor relaxation oscillator.

Upon closing of transistor switch **14**, capacitors **28** and **29** begin to charge through resistors **30** and **31** respectively. The combination of resistor **30** and capacitor **28** produces a long time constant for the second relaxation oscillator in comparison to the time constant resulting from the combination of resistor **31** and capacitor **29**.

The potential at the emitter of unijunction transistor **16** will rise exponentially, in response to the time constant produced by resistor **31** and capacitor **29**, until the breakdown voltage of unijunction transistor **16** is reached. At breakdown, the emitter potential drops to zero.

Simultaneously, the emitter potential of unijunction transistor **15** is rising exponentially at a much slower rate in response to the time constant produced by register **30** and capacitor **28**. Resistor **30** is large for the purposes of a high time constant, therefore unijunction transistor **15** cannot fire because it cannot draw enough current through resistor **30**.

To permit unijunction transistor **15** to fire, the emitter of unijunction transistor **16** is coupled to the nongrounded base of unijunction transistor **15**. When the potential at the emitter of unijunction transistor **16** drops to zero, the breakdown voltage of unijunction transistor **15** is caused to be lowered. Current may now be drawn from capacitor **28** to fire unijunction transistor **15** at time t_1.

The firing of unijunction transistor **15** sends an arming pulse into diode **32** which turns silicon-controlled switch **17** off. Point **18** is now permitted to charge up to potential V_1. The potential rise of point **18** places a potential at the base of transistor switch **14** to open the emitter-collector circuit and cut off further current to electronic arming timer **11**.

Zener diode **19** prevents a false trigger pulse resulting from feedback from the internal impedance of source V_1 from turning silicon-controlled switch **17** back on. Firing capacitor **21** is thus permitted to charge to potential V_1. The fuze is now fully armed and ready for detonation.

Detonation will occur when the potential across firing capacitor **21** is applied, by either trembler switch **22** or clock **23**, via Shockly diode **24** to silicon-controlled rectifier **25**. The silicon-controlled rectifier applies the potential across firing capacitor **21** to a squib **26** for detonation.

Clock **23** may be a simple mechanical clock having contacts which close after a predetermined interval, at time t_3.

Shockly diode **24** acts as a level detector to prevent firing of silicon-controlled rectifier **25** when there is inadequate voltage to fire squib **26**. The breakdown voltage of the Shockly diode is greater than the minimum voltage necessary to fire the squib **26**. Therefore, if the potential across firing capacitor **21** has not reached firing potential, a premature disturbance will not cause insufficient detonation.

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.

We claim:

1. A fuze comprising:

means to initiate electrical timing means;

electrical timing means to delay arming of the fuze for a first interval of time, during which time said arming is prevented;

means to prevent firing of the fuze prior to the end of said first interval of time;

means for simultaneously arming the fuze at the end of said first period of time and preventing further current drain to the electrical timing means;

antidisturbance means for detonating the fuze at any time after the first interval of time; and

mechanical timing means to detonate the fuze after a second interval of time which interval is longer than said first interval of time.

2. The system of claim 1 wherein said electrical timing means to delay arming comprises:

a first unijunction transistor relaxation oscillator having a short time constant;

a second unijunction transistor relaxation oscillator having a time constant approximately equal to the arming delay time;

means for coupling the first and second oscillator so that the output of the first oscillator lowers the breakdown voltage of the unijunction transistor of the second oscillator to ensure breakdown of said transistor at the end of a period equal to one time constant.

3. The system of claim 2 wherein said means to prevent firing of the fuze prior to the end of said first interval of time comprises:

a silicon-controlled switch which grounds the firing circuit upon initiation of said electrical timing means; and

removes said ground upon receiving an output pulse from the electrical timing means.

4. The system of claim 3 wherein said silicon-controlled switch operates a transistor switch which cuts off current to the electrical timing means in response to an output pulse from the electrical timing means.

5. The system of claim 4 wherein the antidisturbance means for detonating the fuze comprises:

a switch capable of firing a properly biased silicon-controlled rectifier which will detonate the fuze.

6. The system of claim 5 wherein the antidisturbance switch is a trembler switch.

7. The system of claim 6 wherein the mechanical timing means for detonating the fuze comprises:

a pair of contacts which when closed are capable of firing a properly biased silicon-controlled rectifier which will detonate the fuze; and

the pair of contacts are closed by a clock timer.