United States Patent [19]

Morrow

[11] **3,837,282**

[45] **Sept. 24, 1974**

[54] **ORDNANCE TIMER USING CHEMICAL LIGHT**

[75] Inventor: **Warren P. Morrow**, Silver Spring, Md.

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

[22] Filed: **July 6, 1973**

[21] Appl. No.: **376,999**

[52] **U.S. Cl.** ..... **102/70.2 R,** 102/82

[51] **Int. Cl.** **F42c 19/00,** F42c 11/00

[58] **Field of Search** ..... 102/70.2 R, 70.2 G, 70.2 P, 102/82, 87; 240/2.25

[56] **References Cited**

UNITED STATES PATENTS

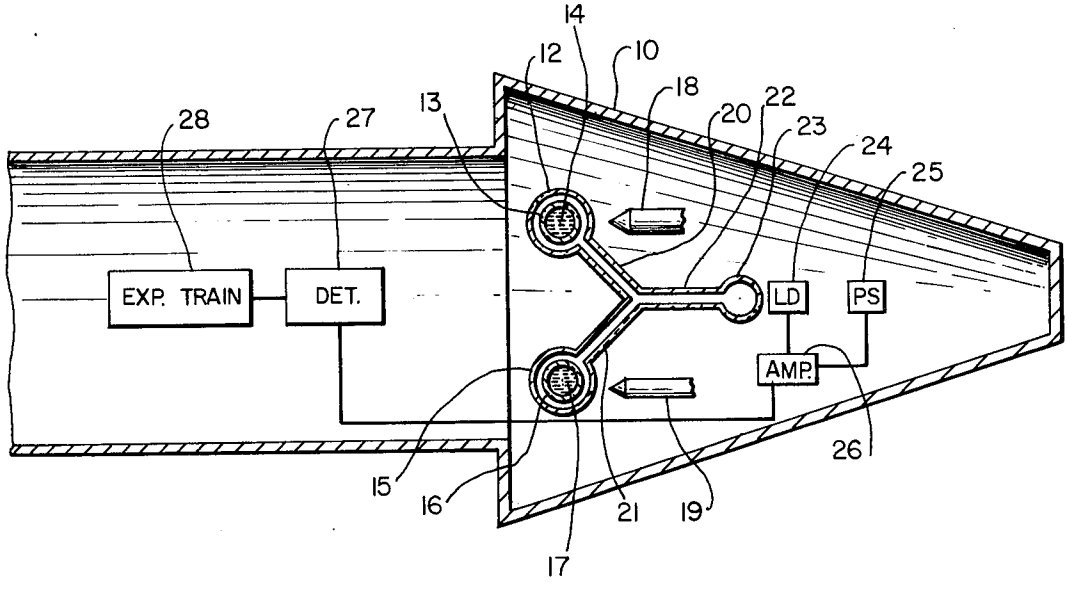
2,060,201	11/1936	Hammond, Jr.	102/70.2 P
2,137,598	11/1938	Vos	102/70.2 P
3,576,987	5/1971	Voight et al.	240/2.25
3,612,857	10/1971	Beatty et al.	240/2.25

Primary Examiner—Benjamin A. Borchelt
Assistant Examiner—C. T. Jordan
Attorney, Agent, or Firm—Edward J. Kelly; Saul Elbaum

[57] **ABSTRACT**

Disclosed is a chemiluminescent ordnance timer. The device comprises essentially of a first ampule which contains a first reactive component, a second ampule containing a second reactive component, a mixing chamber for receiving both reactive components and for transmitting chemiluninescent light which is created by the mixture, a plurality of capillary tubes for imparting a predetermined time delay to the reactive components on their way to the mixing chamber, and finally, means for detecting the chemiluminescent light and for actuating an appropriate mechanism. Each of the ampules containing the reactive components are designed to break upon the application of a predetermined force such as a setback or a spin force which may be encountered in a projectile. Several safety features in the form of fluid sump means are provided along the capillary path to ensure that the detonator will activate only upon a predetermined sequence of events.

7 Claims, 2 Drawing Figures



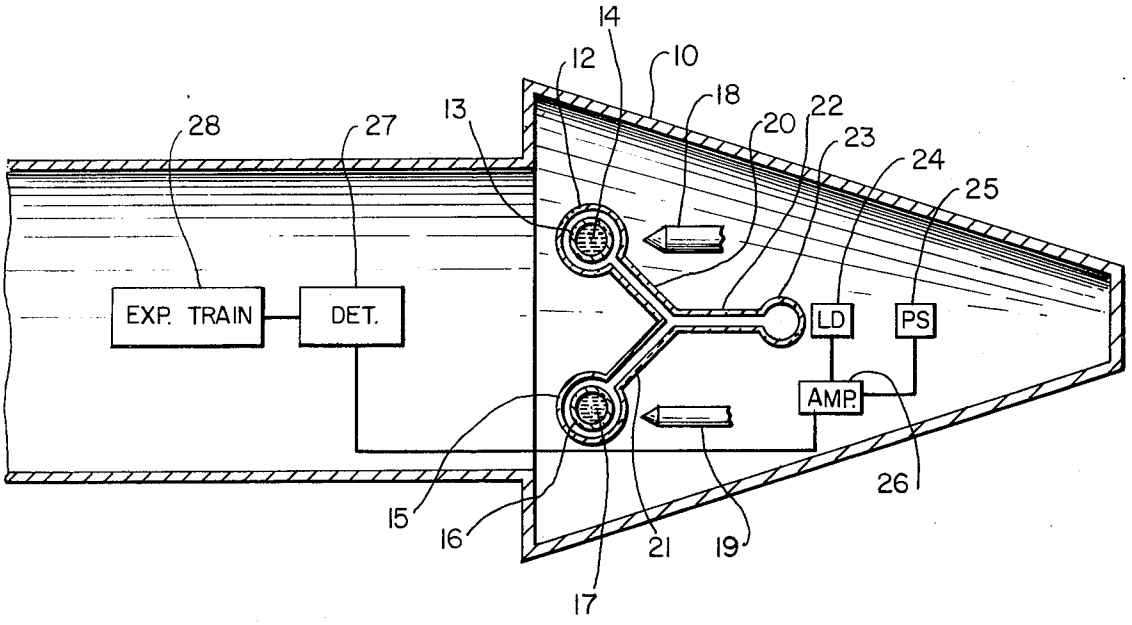

14
12
10
18
22
20
23
24
25
13
28
27
EXP. TRAIN
DET.
LD
PS
AMP.
26
15
16
21
19
17

FIG. 1

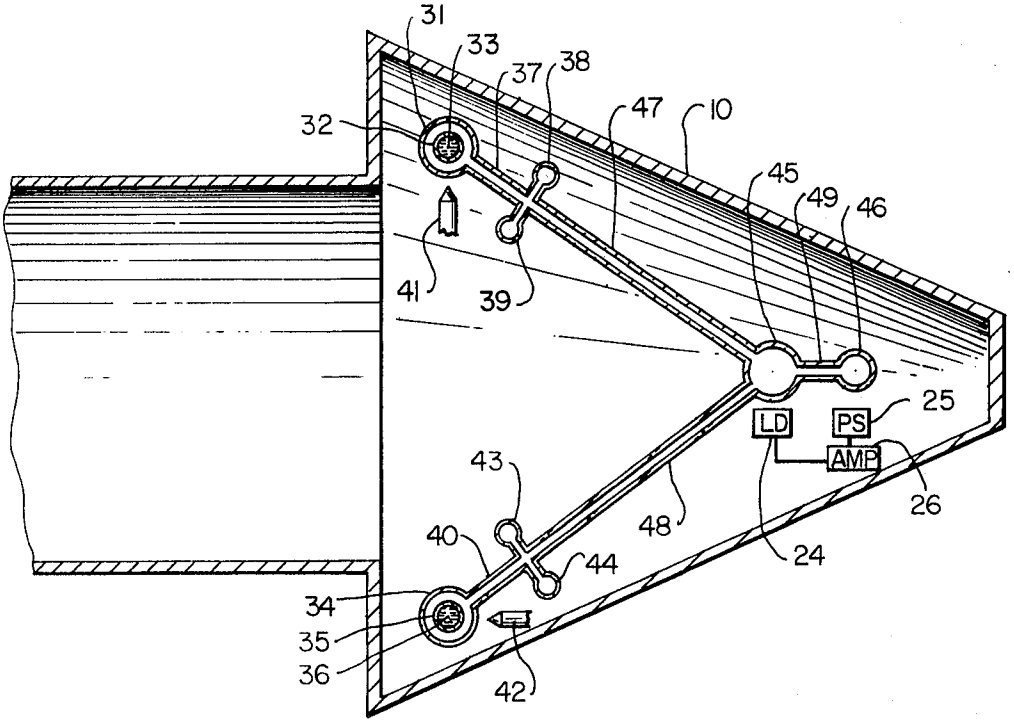

31
33
37
38
32
47
10
45
49
46
41
39
25
LD
PS
AMP
43
26
48
40
44
24
34
35
36
42

FIG. 2

ORDNANCE TIMER USING CHEMICAL LIGHT

RIGHTS OF THE GOVERNMENT

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

BACKGROUND OF THE INVENTION

This invention relates to ordnance devices in general and more specifically to the use of chemical light as a timing device for mine, bomb and tube fired munitions.

The prior art contains numerous examples of systems designed to achieve a delay fuze mechanism. Most such prior art devices have relied upon the use of mechanical devices requiring moving parts which have their obvious disadvantages. The use of electrical delay mechanisms has also been suggested, however, such devices incur the ever present danger of accidental operation through the reception of stray signals or momentary temperature extremes above the ignition temperature of the pyrotechnic device.

Accordingly, it is a primary object of this invention to provide an ordnance timer which avoids all of the abovementioned disadvantages.

An additional object of the invention is to provide an ordnance timer which does not require the use of mechanically moving parts.

Still another object of this invention is to provide an ordnance timer which is simple and rugged in its construction.

An additional object is to provide an ordnance timer which does not depend upon the use of external or additional energy sources.

Still another object is to provide an ordnance timer which is safe and reliable in its operation.

These and other objects of the invention will become more apparent from the following detailed description of the preferred embodiment in conjunction with the drawings.

SUMMARY OF THE INVENTION

Briefly, in accordance with this invention, a chemiluminescent device is provided which comprises a first ampule containing a first chemically reactive component, a second ampule containing a second chemically reactive component, a mixing chamber for receiving the mixture of said first and second components, the mixing chamber being transparent for permitting chemiluminescent light to pass therethrough, a plurality of capillary tubes for directing the reactive components between the ampules and the mixing chamber, and means responsive to the light for actuating a mechanism. The capillary tubes are designed in thickness and length to impart a predetermined time delay to the flow of fluid therein. Each of the ampules are designed to break upon the application of a predetermined setback and/or spin force acting upon the ampule. Appropriate sump means are provided along the capillary tubes to prevent the reactive components from reaching the mixing chamber if the proper sequence of events have not occurred.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The precise nature and operation of the present invention will become clear with reference to the drawings in which:

FIG. **1** is a cross sectional view in schematic format of one embodiment of the present invention.

FIG. **2** is a cross sectional view in schematic format of a second embodiment of the present invention.

Referring now to FIG. **1**, a projectile having a nose cone **10** contains the details of the aforementioned ordnance device. Ampule **13** contains a first chemically reactive component **14** and ampule **16** contains a second chemically reactive component **17.**

The chemically reactive components **14** and **17** are selected such that their mixture will create a clearly detectable chemiluminescent light. The details of this chemical reaction are contained in the specification to U.S. Pat. No. 3,576,987 which patent is hereby specifically incorporated by reference.

Ampule **13** is housed within chamber **12** which communicates to capillary tube **22** through capillary tube **20** and ampule **16** communicates to capillary tube **22** by means of capillary tube **21.** Capillary tube **22** empties fluid into mixing chamber **23.**

In operation, ampules **13** and **16** will be broken by the strikers **18** and **19** which are responsive to predetermined setback forces. This breakage will cause the chemically reactive components **14** and **17** to traverse into capillary tube **22** and to mix in chamber **23,** thereby creating a chemiluminescent light which will be detected by light detector **24.** An electrical signal is then transmitted to and amplified by amplifier **26,** which is provided with a source of power by power supply **25,** and this amplified signal then utilized to activate detonator **27** which in turn will activate explosive train **28** in a known and conventional manner.

Strikers **18** and **19** are designed to respond to different setback forces in a known accepted manner. Similarly, chambers **12** and **15** together with their respective ampules **13** and **16** are designed to break upon the application of the predetermined setback force. The design of ampules capable of breakage upon the application of predetermined setback forces is by now well known in the art and need not be elaborated upon here. it should be apparent from FIG. **1** that sufficient setback forces to activate both strikers **18** and **19** would be required before the mixing chamber **23** would realize both reactive components **14** and **17.**

Still greater safety features are incorporated into FIG. **2** which illustrates again the nose cone **10** containing the details of the present invention. Again, ampules **32** and **35** contain reactive components **33** and **36,** respectively, and are housed within chambers **31** and **34,** respectively. Upon the application of a predetermined setback force, striker **42** would break ampoule **35** causing reactive component **36** to enter capillary tube **40** and continue into capillary tube **48** and finally into mixing chamber **45.** Ampule **32,** containing reactive component **33,** would break only upon the application of a predetermined spin force acting upon striker **41.** Reactive component **33** would then flow into capillary **37,** into capillary **47** and finally into mixing chamber **45.**

Both reactive components **33** and **36** must reach mixing chamber **45** at the same time in order for chemiluminescent light to be detected by light detector **24.** Should one reactive component reach mixing chamber **45** before the second reactive component, the first reactive component would then continue into capillary tube **49** and would dump into sump **46.** Additionally,

should only one ampule be broken, as would occur if the fuze were accidentally dropped, the reactive component from that one ampule would seep into one of the lateral sumps **43, 44** or **38, 39.** Should the second ampule then be broken at a later time, the reactive component captured in the sump would never reach the mixing bowl (or having reached the mixing bowl would already have reached sump **46**) such that the mixing condition in chamber **45** would not occur. This would result in a safe condition.

The spin rate, the inside diameter of the capillary tubing, the length of the tubing and the deceleration rate all contribute to the arming and delay time which is imposed upon the fluid flowing in the capillary tubes. These delay times can, of course, be varied and predesigned to achieve a desired situation and in a manner which would be well within the ability of persons having ordinary skill in this art. Additional features and modifications of the present invention will become apparent tothose having read the instant disclosure. Thus, it is possible to increase significantly the delay times by bending the capillary tubing to thereby create an additional length of tubing. The precise structure of the ampules and associated housing will depend upon current state of the art technology. At the present time, suitable materials would consist of glass, transparent plastics, known laminates and other known components. Accordingly, I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications can be made by a person skilled in the art.

I claim as my invention

1. A chemiluminescent device comprising;

a. a first impule containing a first reactive component;

b. a second ampule containing a second reactive component;

c. a mixing chamber for receiving the mixture of said first and second reactive components and for transmitting chemiluminescent light created by said mixture;

d. means for directing said first and second reactive components from said first and second ampules to said mixing chamber; and

e. means responsive to said light for activating a mechanism.

2. The device of claim **1** wherein said means for directing reactive components comprises capillary tubes for imparting a predetermined time delay to the flow of fluid therein.

3. The device of claim **2** further comprising means for causing said first ampule to break upon the application of a first predetermined force and means for causing said second ampule to break upon the application of a second predetermined force.

4. The device of claim **3** wherein said first and second forces are setback forces.

5. The device of claim **3** wherein said first force is a setback force and said second force is a spin force.

6. The device of claim **3** wherein said means for activating a mechanism comprises means for actuating a detonator and means for actuating an explosive train.

7. The device of claim **3** further comprising sump means associated with at least one of said capillary tubes to prevent said reactive components from reaching the mixing chamber unless the proper sequence of forces have been applied.

* * * * *