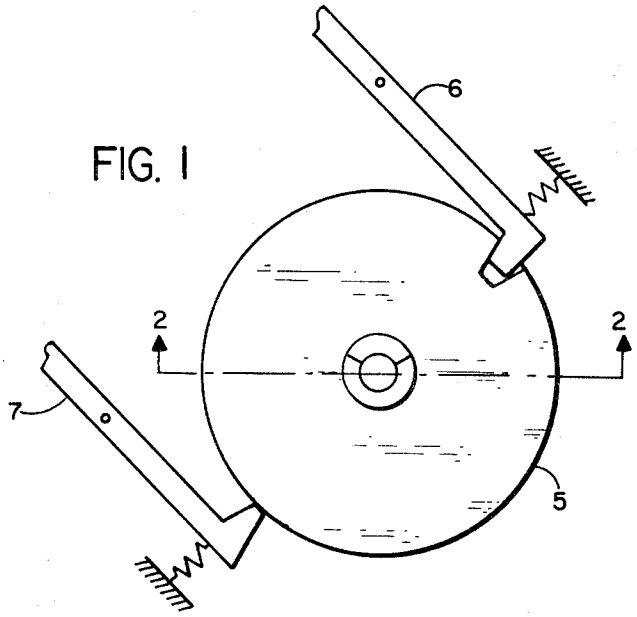
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CONTROL APPARATUS

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FIG. 1



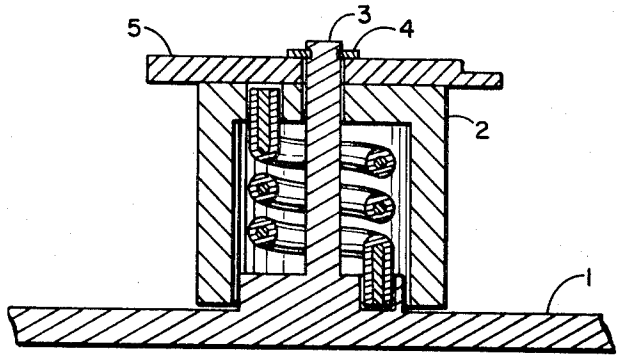


FIG. 2

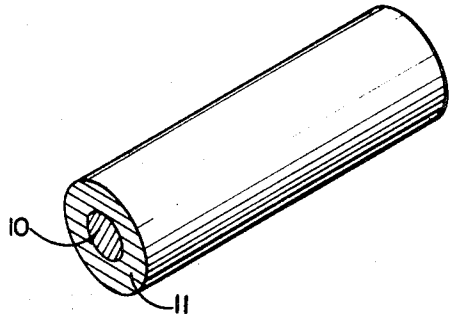


FIG. 3

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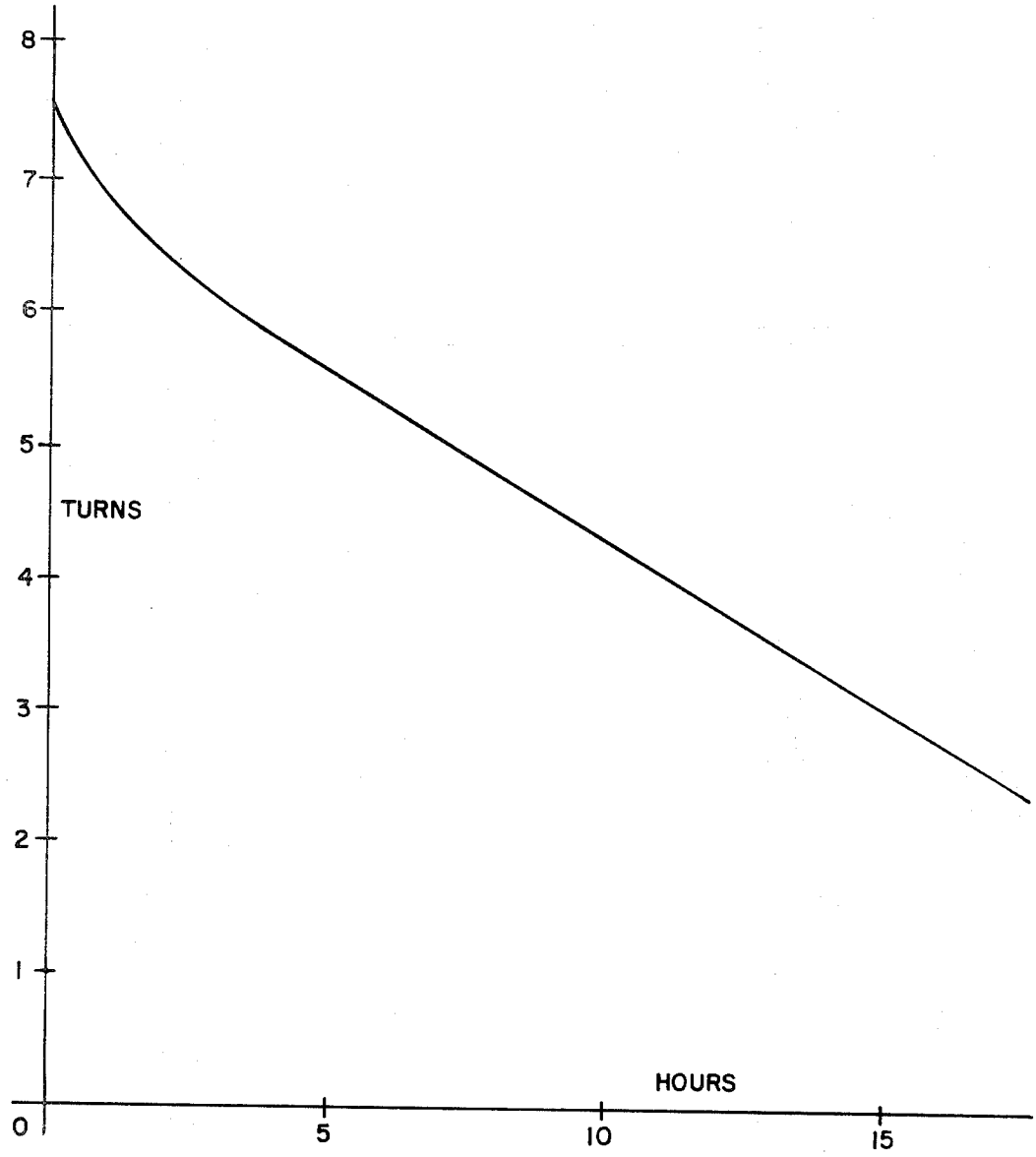


FIG. 4

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3,570,280

CONTROL APPARATUS

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Int. Cl. G05g 17/00
U.S. Cl. 74—3.5 5 Claims

ABSTRACT OF THE DISCLOSURE

A composite material comprising an elastic material in contiguous relationship with a material having the property of creep under stress. The material is contemplaced for use in various configurations to serve a time delay function.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention pertains to composite metals and their use as time delay devices.

Description of the prior art

Numerous timing devices are well-known in the prior art wherein spring action is retarded by a damper. A common example is the spring-shock absorber combination used on vehicles. In this case, the normally fast action of the spring is retarded by the shock absorber characteristics.

Timing devices utilizing a spring-powered clock escapement are also well-known in the art. Again the stored energy of the spring is dissipated at a controlled rate dependent on the clock escapement.

Numerous devices wherein normally fast spring forces are retarded come to mind; however, each have the disadvantage of requiring two separate components: the spring and a damping device.

It is an object of the present invention to provide a composite material having applicability to time delay devices.

SUMMARY OF THE INVENTION

The present invention pertains to the use of a composite material to provide various timing characteristics in a spring device. The invention is concerned with a single component to replace spring-damper combinations of the prior art.

The delay spring of the present invention comprises a material of elastic properties coated with a material having the property of creep under stress. The property of creep is well-known in metallurgy and is exhibited by materials such as lead, copper, and tin. The particular configuration of the device may be varied to satisfy different requirements. The inner core is made from a suitable spring material which provides the necessary stress to allow creep to take place in the outer coating. The time delay characteristics are controllable by varying a number of parameters such as creep material composition and diameter, core material composition and diameter, length (for linear motion) or number of turns (for rotational motion), or spring mean diameter.

The invention is contemplated for use with ordnance devices to replace temperature sensitive chemical timers. A bimetal inner core is contemplated to provide temperature compensation.

The delay spring is desirable over chemical timers in that it may be used more than once. Further, the delay spring will do useful work while providing its delay action, as may be required in an ordnance device for mechanical arming of a munition.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view of a timing device utilizing the material of the present invention.

FIG. 2 is a vertical sectional view through the timing device of FIG. 1.

FIG. 3 is a section of the delay spring material of the present invention as used in the embodiment of FIGS. 1 and 2.

FIG. 4 is a graph representing the performance of a successful embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 2, a rotor **2** is rotatably mounted on a shaft **3** which is part of a base **1**. The rotor **2** is secured to the shaft **3** by a C-ring **4**. A cam disk **5** is secured to the top of rotor **2**.

Referring to FIG. 1, a top view of the device shown in section view in FIG. 2, a pivoted arm **6** engages a notch in the perimeter of cam disk **5**. A second pivoted arm **7** rides on the edge of cam disk **5**.

In operation, the rotor **2** is turned in a counterclockwise direction to a starting point where it is held by engaging pivoted arm **6** with the notch in the perimeter of the disk **5**. At the initiation of the timing sequence, pivoted arm **6** is pivoted away from the cam disk **5** and the disk **5** and rotor **2** are free to turn. The rotor **2** turns in a clockwise direction at a speed determined by the delay spring characteristics until the disk turns approximately one-half a revolution and the pivoted arm **7** engages the notch, causing a desired response, such as release of a striker to initiate an explosive detonator.

FIG. 3 illustrates a section of the composite material of the present invention as employed in the embodiment of FIGS. 1 and 2. An elastic material **10** is contiguously surrounded by a material **11** having the property of creep under stress. Material **10** of FIG. 3 is suitable spring material to provide stress to allow creep to take place in the material **11**. Examples of suitable metals for creep material **11** are lead, tin, solder and copper.

A successful embodiment of the present invention was constructed with an inner core material of .008 inch music wire 7.5 inches in length. The outer creep material **11** was Kester solder alloy Sn60, .062 inch in diameter and 7.5 inches in length. The spring material was wound in a coil having an outside diameter of .374 inch with an inside diameter of .250 inch. The original number of turns was 7¾ and the original free length was .508 inch.

Operation of the spring is shown in the graph of FIG. 4. The curve presented is the number of turns in the delay spring as a function of time. Data was taken at +35 degrees Fahrenheit.

The delay spring will tend to return to its original configuration as long as deformation is within the elastic limits of the inner core material and the elastic material exerts enough stress on the creep material.

The properties of the delay spring of the present invention can be realized by many different configurations. It is understood, therefore, that the specific embodiments of my invention shown here are for the purpose of illustration only, and that my invention is limited only by the scope of the appended claims.

What is claimed is:

1. Timing apparatus, comprising:

a deformable composite material of an elastic material in contiguous relationship with a creep material, having a preferred configuration; and

means in operative combination with said composite material for indicating the configuration of said com-

posite material, whereby said composite material, after deformation within the elastic limits of said elastic material, returns to said preferred configuration after a predetermined time interval.

2. A timing device comprising:

a base member having a shaft thereon;

a rotor rotatably mounted on said shaft;

a delay spring of an elastic material contiguously related to a creep material; and

means engaging said spring to said base and said rotor whereby as said rotor is rotated about said base said spring is stressed and said spring tends to return to its unstressed position after a predetermined time interval.

3. The apparatus of claim 2 where said rotor has a cavity therein and said delay spring is located within said cavity and around said shaft.

4. The timing device of claim 3 wherein said first elastic material is a spring metal.

5. The timing device of claim 3 wherein said second

creep material is chosen from the group consisting of lead, tin, copper, and combinations thereof.

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MILTON KAUFMAN, Primary Examiner

U.S. Cl. X.R.

267—182; 102—82