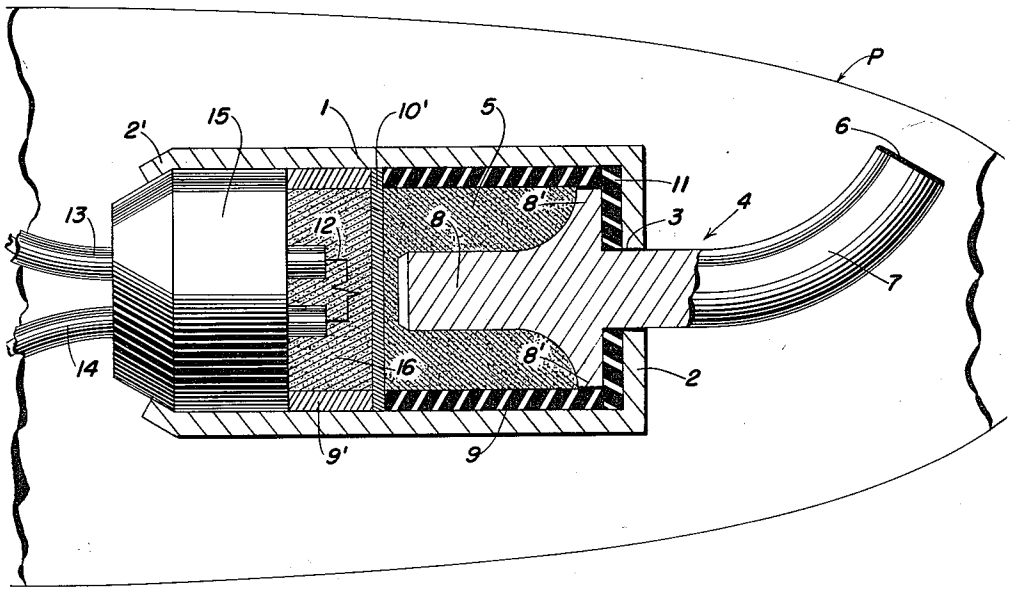
Jan. 19, 1960 N. H. RICKER 2,921,525

THERMAL TIME DELAY UNSHORTER FOR PROTECTION OF DETONATING SQUIB

Filed Oct. 31, 1947

FIG. 1



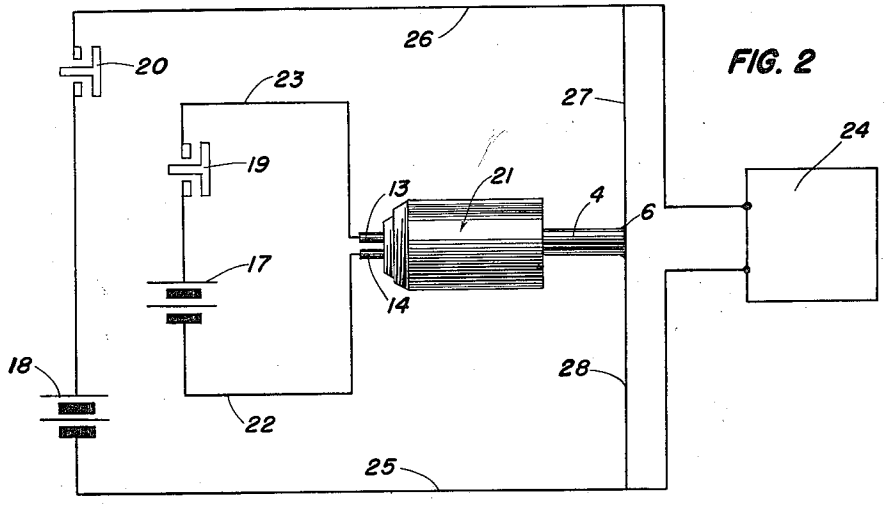




FIG. 2

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United States Patent Office 2,921,525
Patented Jan. 19, 1960



2,921,525

# THERMAL TIME DELAY UNSHORTER FOR PROTECTION OF DETONATING SQUIB

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Application October 31, 1947, Serial No. 783,361

3 Claims. (Cl. 102—70.2)

This invention relates to a thermal type time delay device for an unshorting switch in a detonating squib circuit. It is intended to be used as a timing aid for shell fire.

In previous time delay mechanisms it was necessary to employ moving parts accentuated by acceleration forces, centrifugal forces, or spring forces. These timing devices were subject to errors due to the forces of acceleration within the projectile, which errors are sought to be overcome by changing the device, as described herein.

Therefore it is an object of this invention to provide an accurate time delay control for the unshorting switch in a detonating squib circuit.

It is another object of the invention to produce a time delay switch which will operate effectively without making use of moving parts.

A further object of the invention is to provide an accurate method of time delay control.

A still further object of the invention is to provide a time delay switch ruggedly constructed so that it will resist shocks and jars due to handling without igniting the detonator.

Other objects and many of the attendant advantages of this invention will be appreciated readily as the same becomes understood by reference to the following detailed description, when considered in connection with the accompanying drawings, wherein:

Fig. 1 is a partly sectional view taken along the longitudinal axis, showing the lead wires and the holding block in elevation; and

Fig. 2 is a diagram of the electrical circuit.

Referring now to the drawings in which like characters represent like parts throughout the different views, 1 is a cylindrical container which houses the working mechanism. One end of the container 1 is formed in a frusto conical shape 2' which may be made by any convenient method such as spinning, for example, in the process of assembly. The other end is closed by a base 2 penetrated by hole 3 through which a thermo-pin 4 extends. Thermo-pin 4 is constructed and designed with a flange 8' between its two ends, bearing outwardly against the base 2.

The internal portion 8 of the thermo-pin 4 is housed in the container 1. The external portion 7 of the pin 4 extends outwardly from the container 1 a distance determined by the time delay desired. At this point it is desired to state that one use of the device is in conjunction with a projectile P as illustrated in the drawing. The flange 8' is designed with a filleted face to enhance heat conduction along the thermo-pin 4, and to increase the strength of the flange 8'. The shunt short circuit makes connection with the thermal switch by a soldered joint 6 at the external end of the thermo-pin 4. Container 1 is lined by an insulating sleeve 9 of suitable material, such as mica, and the container base 2 is faced on the inside with a convenient insulation such as a mica washer 11. This mica insulation is used to reduce the heat losses due to conduction through the container walls.



The ignition assembly comprises the lead wires 13 and 14 which furnish the current to heat the ignition filament 12. The plug 15 through which the leads 13 and 14 pass has a frusto conically shaped end which forms the male part of the sealing joint 2' in assembly. A spacer 9' holds the plug 15 out against the frusto conical end of container 1. This insures a tight joint at all stages of the ignition delay. The thermal igniting substance 16 is separated from the thermal substance 5 by partition 10', which divides container 1 into two compartments, to keep the two materials from mixing and reacting upon each other. The thermal material is tightly positioned around pin portion 8 and against flange 8' thus securely holding thermo-pin 4 in position before ignition. After ignition the gas pressure acting against flange 8' continues to hold thermo-pin 4 securely against mica washer 11 and base 2.

In referring to electrical diagram Fig. 2, battery 17 supplies current for the igniter filament 12 in the thermal time delay switch, now designated 21, through wires 22 and 23, and leads 13 and 14, when the set back switch 19 is engaged. Battery 18 supplies current to the detonator 24 through wires 25 and 26 when set back switch 20 is closed and shorting wires 27 and 28 are disconnected by the action of the thermal delay unshorting switch 21.

In operation the device is started when acceleration forces of projection close the set back switches 19 and 20. Current flows through wires 22 and 23, and leads 13 and 14 to the igniting filament 12 which ignites the thermal igniting substance 16. The high temperature of the thermal igniting substance 16 ignites the thermal mixture 5, thereby raising the temperature of the capsule over a brief interval of time. Heat begins to flow along the thermo-pin 4 from 8 to 7. The length of the thermo-pin in conjunction with the material in the pin will determine the time delay for the completion of the action. When temperature at 6 increases sufficiently to melt the solder joint 6 the short circuit 27 and 28 is broken. Battery 18 then discharges through wires 25 and 26 to the squib 24 which sets in operation the detonation of the powder train.

In conclusion it is pointed out that the use of the device is not intended to be confined to projectiles since it is anticipated that the ignition of detonatable charges elsewhere is capable of being controlled with equal facility.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A device of the character described; comprising a heat conductor; a cylindrical container open at one end and having a base at the other end with a hole therein through which said conductor extends; a flange formed integrally with said heat conductor bearing outwardly against said base; a flange fillet connecting said flange to the inward portion of the heat conductor; an insulating washer positioned between said flange and said base; a heat producing substance within said container and positioned around said heat conductor, said fillet, and said flange; an insulating sleeve positioned between said substance and said container; a partition within said container dividing said container into two compartments and bearing against said substance; an igniting substance within said shell and bearing against said partition, a plug sealing the opening in said shell; and an electrical circuit with a filament therein, said filament being embedded in said igniting substance.

2. A device of the character described, comprising an electrical circuit, a fusible element shorting out said cir-

cuit, a heat conductor having one end connecting with said element, a cylindrical container open at one end and having a base at the other end with a hole therein through which said heat conductor extends, a flange formed integrally with said heat conductor bearing outwardly against said base, a heat producing substance within said container and positioned around said heat conductor and said flange, a partition within said container dividing said container into two compartments and within one of which is positioned said substance, an igniting substance positioned within the other compartment, a plug sealing the opening in said container; and an electrical means for igniting said igniting substance held in position by said plug.

3. A device of the character described, comprising an electrical circuit with a squib therein; a fusible element shorting out the squib; a heat conductor having one end connected with said element; a cylindrical container having a plug at one end and a base at the other end formed around said heat conductor; a flange formed integrally with said heat conductor bearing outwardly against said base; a fillet connecting said flange to the inward portion of the heat conductor; an insulating washer positioned between said flange and said base; a heat producing substance within said container and positioned around said heat conductor, said fillet, and said flange; an insulating sleeve positioned between said substance and said container; a partition within said container dividing said container into two compartments, said substance being positioned within one of said compartments, and adjacent to said conductor; an igniting substance within said container and positioned within the other compartment; an electrically heated filament embedded in said igniting substance; and an electric circuit energizing said filament.



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