June 9, 1959 J. RABINOW 2,889,777

ELECTRICAL ARMING MECHANISM FOR FUSES

Filed May 31, 1951

Fig. 5.

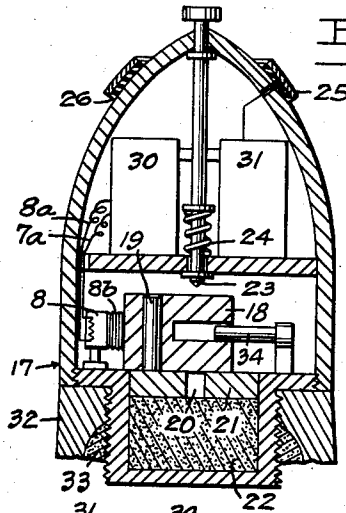


Fig. 1.

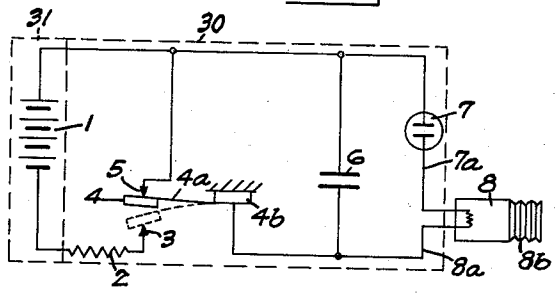
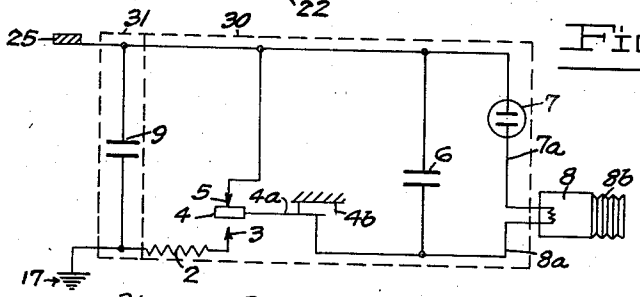


Fig. 2.



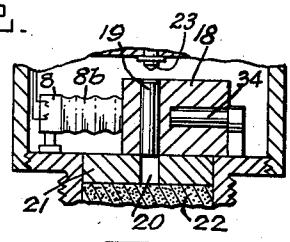


Fig. 6.

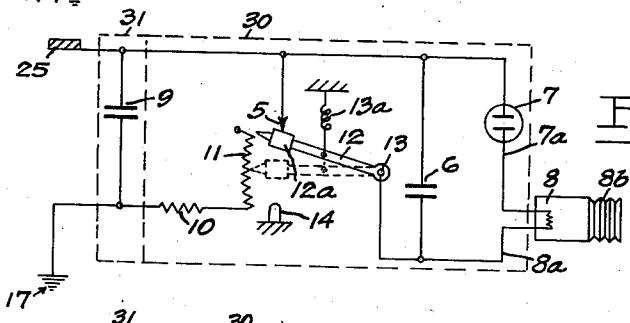


Fig. 3.

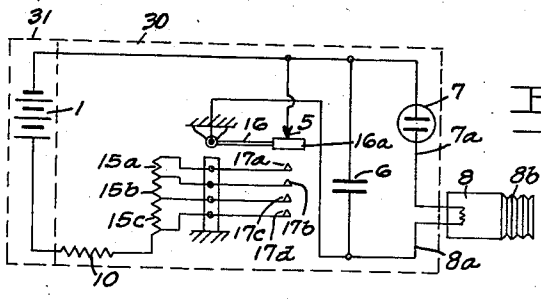


Fig. 4.

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ELECTRICAL ARMING MECHANISM FOR FUSES

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Application May 31, 1951, Serial No. 229,241

3 Claims. (Cl. 102—70.2)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty thereon.

This invention relates to arming means for fuses and more particularly to electrical arming means.

An object of the invention is an electrical arming means which will arm the fuse after the missile has traveled a predetermined safe distance.

Another object of the invention is an electrical arming means for fuses in explosive missiles which will not arm the fuse when the missile is dropped or subjected to repeated brief accelerations.

Another object of the invention is an electrical arming means for fuses in which automatic integration of acceleration controls the arming time.

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

Figure 1 is a schematic diagram of the arming device of the invention wherein the electrical energy is supplied by a battery.

Figure 2 is a schematic diagram of the arming device of the invention wherein the electrical energy is supplied by a charged capacitor.

Figure 3 is a schematic diagram of a modification of the device wherein automatic integration of acceleration controls the time of arming.

Figure 4 is a schematic diagram similar to that of Figure 3, but showing a modification of the integration means of Fig. 3.

Figure 5 is a longitudinal sectional view of a fuse embodying the arming device of the invention.

Figure 6 is a fragmentary view showing the fuse in armed position.

Referring now to Figure 1, a battery **1** supplies the electrical energy used to operate the electrical arming mechanism. One terminal of this battery is connected to a terminal of resistor **2**, the other terminal of the resistor is connected to a contact **3**. An inertia switch composed of contact weight **4** and leaf spring **4***a* mounted on a suitable support **4***b* is so arranged that under the forces of acceleration weight **4** may take the position shown in dotted line and make electrical contact with contact **3**. The support **4***b* is secured inside of a housing **30** in which the components of the circuit are contained. A similar housing **31** contains the power supply which may be either a battery **1** or a charged capacitor **9**. In normal position, contact weight **4** makes electrical contact with contact **5** which is connected to the other terminal of battery **1** and to one terminal of capacitor **6** and to trigger tube **7**. The other terminal of trigger tube **7** is connected to one terminal of the fusible element of an explosive motor **8**. The explosive motor has formed integral therewith a bellows **8***b*, the purpose of which will become apparent from the subsequent explanation. The other terminal of the fusible element is connected to the other terminal of capacitor **6** and to a support **4***b* which makes electrical contact with arm **4***a* and thus

with contact **4**. It will be seen that when the system is physically at rest, no current can flow from battery **1** since contact **3** is open. Furthermore, a circuit exists between contacts **4** and **5** thus shorting capacitor **6** and discharging any charge which may have accumulated on it from any momentary current which might be caused by instantaneous contact between contacts **4** and **3** such as might result from dropping a fuse which includes this system. When this system is caused to move in the line of flight of the missile, inertia causes contact **4** to make electrical contact with contact **3** and thus current flows through resistor **2** to charge capacitor **6**. The time of charging is determined by the voltage of battery **1** and the RC network comprising resistor **2** and capacitor **6**. When the charge on capacitor **6** is such that the firing voltage of trigger tube **7** is obtained, this capacitor discharges through the trigger tube and through the fusible element in the explosive motor **8** causing the motor to fire and align the detonator **19** with the flashport **20**.

Referring now to Figure 2, it will be seen that a tank capacitor **9** may be substituted for battery **1** of Figure 1 as a source of electrical energy. Connections in this circuit are as described in connection with Figure 1 except that one terminal of capacitor **9** is connected to the body **17** of the fuse, and the other terminal to an additional element **25** as best shown in Figure 5.

Figure 3 is similar to Figure 2 except that the simple inertia switch consisting of elements **3**, **4**, and **4***a* is replaced by a mechanism which is capable of varying the resistance of the RC circuit in accordance with the acceleration of the missile. A limiting resistor **10** in series with a variable resistor **11** is substituted for resistor **2** of Figure 1. An arm **12** is provided with a contact **12***a* which is normally held free of resistor **11** and in contact with contact **5**. Arm **12** may be suitably pivoted as at **13** and may be spring biased by means of a spring **13***a*. A stop **14** is provided to prevent overtravel of arm **12** and contact **12***a*. In the unarmed condition, the tank capacitor circuit is open and capacitor **6** is shorted as shown in solid line. Under the forces of acceleration, contact **12***a* is urged by inertia to overcome the resistance of spring **13***a* and to assume a position somewhere along resistor **11** as shown in dotted line, the position being determined by the degree of acceleration and the strength of spring **13***a*. It will be seen that the greater the acceleration, the less of resistance **11** there will be in the circuit and thus the more rapid the charging of capacitor **6** and arming of the circuit.

Figure 4 shows a variant of the circuit of Figure 3 wherein the variation of resistance in the RC circuit is accomplished in steps rather than continuously. Here the limiting resistor **10** is in series with a bank of resistors **15***a*, **15***b*, and **15***c*. The resistors are connected to suitable switches (e.g., leaf switches) as shown. Arm **16** with contact weight **16***a* is maintained in the unarmed position by a spring (not shown) similar to that of Figure 3. Under the forces of acceleration, contact weight **16***a* is withdrawn from contact **5** and makes contact with contact **17***a*, thus putting resistors **15***a*, **15***b*, and **15***c* in series between limiting resistor **10** and capacitor **6**. As acceleration increases, contact is made between contacts **16***a* and **17***b* thus shorting out resistor **15***a* so that there is less resistance in the circuit. Further increase in acceleration causes contacts **17***b* and **17***c* to complete a circuit thus shorting out resistors **15***a* and **15***b*. Contacts **17***c* and **17***d* are likewise closed to short out resistor **15***c*.

Figure 5 shows an embodiment of the invention employed in a missile **32** having an explosive charge **33** therein. The fuse housing **17** encloses the arming means, as well as the power supply and electrical components which are housed in members **31** and **30**, respectively.

Members 30 and 31 are positioned in the forward part of the housing 17 and separated from a slidable arming block 18 containing a detonator 19 held out of register with the firing pin 23 and flash port 20 in the plate 21 by means of an explosive motor 8 having a bellows 8*b* affixed to the block. The arming block rides on a guide member 34 as illustrated in the drawing. The firing pin 23 is slidably mounted in the nose of housing 17 and is spring biased forwardly by means of spring 24. A contact ring 25 insulated by means of insulator 26 which is mounted on the housing 17 connects the capacitor 9 with a power source in the launcher or projector, not shown, to charge the capacitor 9. Leads 7*a* and 8*a* connect the explosive motor 8 with trigger tube 7 and capacitor 6. If the firing pin 23 were struck when the fuse was in unarmed condition, as shown in Figure 5, its point would harmlessly strike arming block 18.

Figure 6 shows a portion of the fuse in Figure 5, but in armed condition. The explosive motor 8 has fired, forcing arming block 18 into position such that the detonator 19 is in register with hole 20 in plate 21, and is also directly under firing pin 23. If pin 23 is now struck, it will fire detonator 19 which will flash through hole 20 activating the booster 22 and subsequently causing detonation of the explosive missile.

Other forms of electrical integration can also be used, such as for instance RL networks where the electrical energy is stored in an inductance in place of the capacity described above.

I claim:

1. An electrical arming system for a fuse, comprising a capacitor, a resistor, the capacitor and resistor forming a timing network, an acceleration responsive means, said means adapted to connect the capacitor with the resistor thereby forming a series circuit, charging means for said network, the acceleration responsive means comprising a spring biased lever pivoted at one end, the free end of the lever arranged for slidable contact with said resistor, the pivoted end of the lever connected to a terminal of the capacitor, said free end slidable across the resistor a distance proportional to the force of acceleration of the fuse to vary the time constant of said network and the arming period of the fuse, a trigger tube, an explosive motor, said tube and motor series connected across said capacitor, the capacitor discharging through said tube at the termination of said arming period whereby said motor is activated and the fuse armed.

2. An electrical acceleration integrating arming system for a fuse in an explosive missile comprising a capacitor, a multi-tap resistor, said capacitor and resistor series connected and forming a timing network, charging means connected across said network, electronic triggering means, an explosive motor, acceleration responsive means, a multi-leaf switch, said triggering means and motor series connected across said capacitor through said switch and acceleration responsive means, said acceleration responsive means comprising a spring biased pivoted arm, said arm being in cooperative relationship with said multi-leaf switch, the taps of said resistor sequentially connected to the leaves of said switch, said arm pivoting about its pivot in response to the force of acceleration imparted to said fuse to engage said leaves and sequentially shunt out certain portions of said resistor and thereby vary the charging time of said network and correspondingly the arming period of said fuse.

3. The combination of a point detonating fuse and an electrical arming system in the housing of said fuse, said housing having a perforation in the nose end and a flash port in the base end, a firing pin, said pin slidable in said perforation and having its major portion directed inwardly of said nose end along the longitudinal axis of said housing in alignment with said flash port, an arming block, said block slidable on said base transversely of the longitudinal axis and positioned in said housing between the base and firing pin, a detonator in said block, an explosive motor, said motor having one end affixed to said base and the opposite end thereof affixed to the block, a capacitor, a resistor, acceleration responsive means, said acceleration responsive means adapted to series connect said capacitor and resistor thereby forming a timing network, said acceleration responsive means comprising a spring biased pivoted lever, the free end of said lever positioned for slidable contact with said resistor, the pivoted end of said lever connected to a terminal of said capacitor, a triggering tube, said tube and said motor connected in series across said capacitor, the free end of said lever slidably contacting said resistor in response to acceleration imparted to said fuse whereby the resistance of said network is varied establishing the time required to charge said capacitor to the firing potential of said tube in terms of acceleration of said fuse, said capacitor thereupon obtaining said firing potential discharging through said tube to fire said motor, the motor thereupon moving the arming block transversely on said base to align the detonator with the firing pin and flashport.

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