Jan. 19, 1960 M. APSTEIN 2,921,522

MULTIPLE DETONATOR OPERATION

Filed March 13, 1952

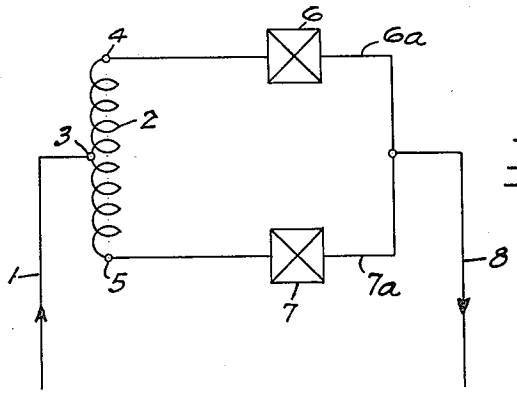


Fig. 1.

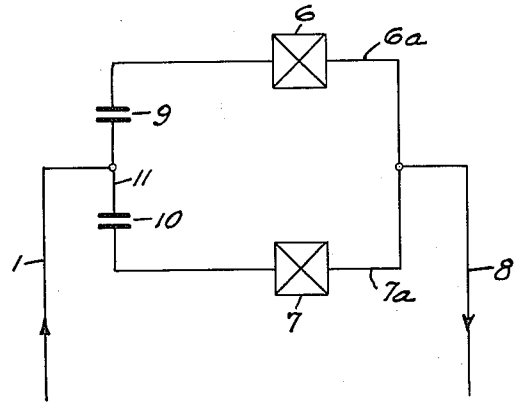


Fig. 2.

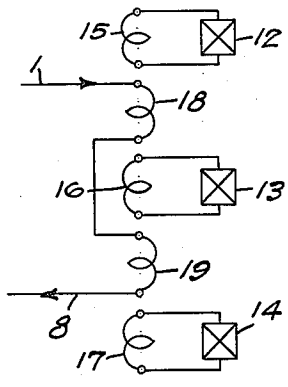


Fig. 3.

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MULTIPLE DETONATOR OPERATION

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3 Claims. (Cl. 102—70.2)

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

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

In order to insure that proximity and/or electrical types of fuses employed in artillery projectiles, guided missiles and the like shall function despite a defective detonator, it is desirable that two or more detonators be used and so arranged that both may fire or that either will fire if the other is short circuited or open circuited. To this end, the novel circuitry of the invention hereinafter described has been devised.

Multiple detonator firing is accomplished by introducing a plurality of coupled isolating impedance elements in series with each of the detonators. This prevents one detonator from short-circuiting the others. As will become apparent, either inductance or capacitance may be used as the isolating impedance, although inductance is to be preferred.

Another object of the invention is a novel circuit means whereby positive functioning of electrically actuated detonators in proximity fuses or other detonator functioned devices is insured.

Another object of the invention is means whereby a multiplicity of detonators may be caused to fire or the remainder of detonators in the circuit may be fired irrespective of faulty detonators or connections thereto.

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

Figure 1 shows an embodiment of the invention whereby two detonators are functioned through an inductive means.

Figure 2 shows a modification of the circuit of the invention.

Figure 3 shows another modification of the invention.

Referring more particularly to the drawings wherein like reference characters designate the same parts throughout the drawings, number **1** indicates an electrical feed line of a proximity fuse or any electrical detonator exciter means, not shown, connected to the center tap **3** of a choke **2**. One end terminal **4** of the choke is connected to a lead of detonator **6** and the opposite end terminal **5** to a lead of detonator **7**. The remaining leads **6***a* and **7***a* of the detonators are joined in a common return circuit **8** of the exciter means. When a pulse of current is applied to the inductive means **2** through feed line **1**, it will divide equally about tthe center tap **3** and will proportionately flow through detonators **6** and **7** to the return circuit **8**. If, for example, detonator

6 is open circuited, all the current will flow through detonator **7**. If, on the other hand, detonator **6** is short circuited, the current will pass in approximately equal amounts through the short circuited detonator **6** and the operating detonator **7** because of the negligible resistance of the detonators and thus cause detonator **7** to function.

In the modification shown in Figure 2, the electrical detonator firing circuit is substantially the same as that shown in Figure 1 with the exception that the series connected capacitors **9** and **10** have been substituted for the center tapped choke **2**. In this modification the feed **1** line is connected to the series connector **11** in order to provide an equal amount of energy for the detonators.

Another system for insuring detonation of explosive missiles or the like is shown in Figure 3 wherein the detonators **12**, **13** and **14** are connected across spaced coils **15**, **16** and **17**, respectively. Positioned in inductive relationship to coils **15** and **16** is a coil or link coupling **18** which is in series with a similar coil or link **19** positioned in inductive relationship between coils **16** and **17**. The terminals of the series connected coils comprising link coupling means are connected across the feed line **1** and return circuit **8**. In operation, a pulse of current is caused to flow in the link coupling means which in turn induces a current in each of the detonator shunted coils to function the detonators. It is apparent that irrespective of the fact that some detonators or circuits thereof may fail to function, detonation of the explosive missile in which the invention is incorporated may be obtained if but one detonator and circuit remain in operative condition.

It will be apparent that the embodiments shown are only exemplary and that various modifications can be made in construction and arrangement within the scope of the invention as defined in the appended claims.

I claim:

1. A detonator firing circuit comprising an inductive reactance element, said element having a center tap and opposite terminals, two series connected detonators shunted across said terminals, electrical energy supply means comprising a feed line and a return circuit, said feed line connected to the center tap of said element, and said return circuit connected to a point intermediate the series connected detonators.

2. A detonator firing circuit comprising an isolating impedance, said isolating impedance provided with end terminals and an intermediate terminal, a pair of series connected detonators, an electrical feed line and a return circuit, said series connected detonators shunted across said end terminals, said feed line connected to said intermediate terminal, and said return circuit connected to a point intermediate said series connected detonators.

3. A detonator firing circuit comprising an autotransformer, two series connected detonators shunted across the end terminals of said autotransformer, an electrical feed line and a return line, said feed line connected to a tap on the autotransformer intermediate the said end terminals, and said return line connected to a point intermediate the series connected detonators.

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