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ELECTRIC DETONATORS

Filed July 14, 1959

Fig. 1

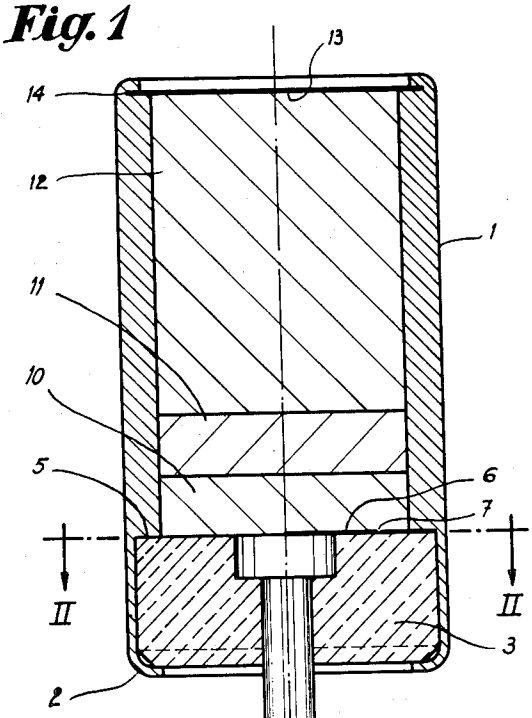


Fig. 3

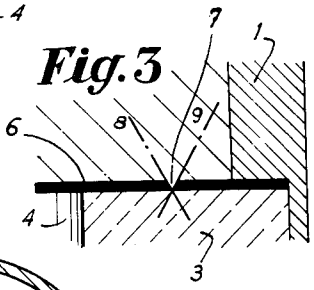
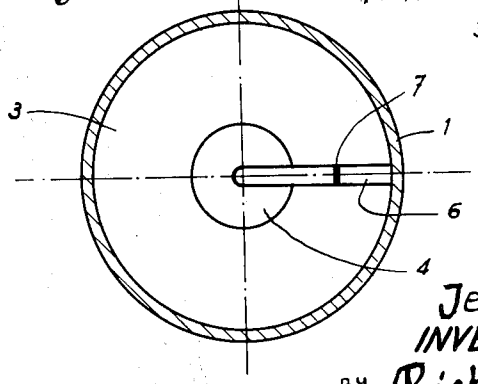


Fig. 2



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ELECTRIC DETONATORS

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This invention concerns electric detonators for projectiles and more especially those detonators comprising an electric conductor mounted between two electrodes and provided with a gap.

It is a known fact that with such detonators, the application of a voltage applied to aforesaid electrodes across the gap gives rise to a spark which is sufficiently strong to fire instantly the surrounding charge of explosive substances.

Such detonators must strictly fulfill certain fundamental requirements. Minimum requirements are:

(*a*) That the conductor containing the gap be chemically neutral with respect to the explosive substance with which it is in contact, this is to prevent any detrimental chemical reactions;

(*b*) That the constituent elements of the detonator do not undergo any alteration nor modification whilst kept in store, this is to ensure a certain and systemmatic functioning at any time, however long they may have been kept in store;

(*c*) That there should be no alteration of the conductor stretching between both electrodes, and namely there where the gap is located, this is to ensure that the adjacent ends of aforesaid conductor on either side of the gap be maintained absolutely intact so that the spark might normally jump the gap;

(*d*) That the manufacturing process of such detonators should be very simple, economical and capable of yielding a product all constituent parts of which are strictly constant in all respects.

All the above conditions are fulfilled by the improvements revealed in the present invention. These improvements are essentially characterized by the fact that between both electrodes at least one line or stroke of an electrically conductive substance is inserted, this substance being mostly graphite or some graphite compound and the line or stroke of this substance being cut across at some point of its length and brought into cotnact with the explosive charge.

According to the invention, this line, stroke or thin strip of graphite comprising a gap, acts as an electrical conductor bridging-over both electrodes.

In one preferred embodiment of the invention, aforesaid electrodes are concentric, whereas the strip of graphite is fitted radially to both, so that at one of its ends it is in permanent contact with one of the electrodes, and with its other end it is in permanent contact with the second electrode, the line, stroke or strip of graphite being cut across at some part of its length between both electrodes, and at least at the location of the resulting gap, comes into direct contact with the explosive charge.

It is quite obvious of course, that the shape, the dimensions and the relative positions of aforesaid electrodes with respect to the electrical conductor consisting of a line, stroke or strip of graphite fitted with a gap, are essentially variable.

It is thus only by way of example that one particular embodiment of the invention is described in greater detail below, with reference to the appended drawing, of which:

FIGURE 1 is a radial section of a detonator conforming to the present invention;

FIGURE 2 is a cross-section by a plane normal to the axis and containing line II—II of FIGURE 1;

FIGURE 3 is a partial radial cross-section drawn at a larger scale.

In this particular embodiment, electrode **1** assumes the shape of a cylindrical envelope, the bottom edge **2** of which is curved inward so as to act as a retainer for a mass **3** of substance which is an electrical insulator, such as an appropriate synthetic material, into which the second electrode **4** is axially embedded. Aforesaid insulating mass **3** is thus held between aforesaid lower edge **2** and a shoulder **5** extending to the corresponding bore of aforesaid cylindrical electrode. Onto the upper face of aforesaid insulating mass **3**, a radial line or stroke **6** of graphite, or of some composition containing graphite; is drawn and extends from the central electrode **4** right to the periphery of aforesaid insulating mass **3**, so as to be in contact with the adjacent part of the outer electrode **1**. This line or stroke of graphite **6** is cut across at **7**. Preferably, the edges of this gap will be cut at a slant as shown diagrammatically in **8** and **9** of FIGURE 3, this particular shape having proved to be the most effective.

As can readily be seen on the drawing, the graphite stroke **6** with a gap at **7** is thus formed of two separate sections of which one is in contact with the outer electrode **1** whereas the other is in contact with the central electrode **4**. Explosive charges **10**, **11** and **12** are stacked upon the insulating mass **3** and the electrode **4** and are located within the container formed by the electrode **1**; they are held in place by a lid **13** engaging an annular slot formed by the electrode **1**.

When a sufficiently high voltage is applied across the electrodes, a spark will jump across aforesaid gap **7** and will instantly and systematically fire the explosive charge.

It will of course be appreciated that the graphite or the compound containing graphite could, without exceeding the scope of the present invention, be replaced by any other substance or compound which fulfills the fundamental requirements of the invention, i.e. which is at least a good conductor of electricity, perfectly stable and also neutral with respect to the other products with which the conductor in question comes into contact inside the detonator.

In one preferred embodiment of the present invention, this line or stroke of graphite or graphite compound, or of any other substance fulfilling the same functions, can be made or applied in a continuous way starting from the center of the axial electrode **4** and extending to the periphery of the insulating mass **3**, this line or stroke being then provided with a gap, i.e. cut-across by means of an appropriate blade.

The very simple means described above, lend themselves to a fast and very economical mass production and it is quite possible to determine with a considerable degree of accuracy, the position, the thickness and the shape of the edges of the gap.

The present invention covers all and sundry embodiments of the characteristics which have been described above.

What I claim is:

1. An electrical detonator, comprising a tubular electrode having an inwardly curved bottom edge, another stem-like electrode having a head and partly located within the tubular electrode and extending axially thereto, insulating material carried by said curved bottom edge of the tubular electrode and separating said tubular electrode from said stem-like electrode, said stem-like electrode extending through said insulating mass, a line-shaped electrical conductor extending upon said insulating mass between said electrodes and adapted to constitute an electrical connection therebetween, said conductor having a gap separating it into a portion connected with said tubu-

lar electrode and another portion connected with the head of said stem-like electrode, explosive substances stacked upon said insulating material within said tubular electrode and in contact with said conductor, said conductor being chemically neutral with respect to the explosive substance with which it is in contact, and a lid closing said tubular electrode to maintain in place said explosive substances.

2. An electrical detonator, comprising two separated electrodes, a line-shaped electrical conductor extending between said electrodes and adapted to constitute an electrical connection therebetween, said conductor having a gap separating it into a portion connected with one of said electrodes and another portion connected with the other one of said electrodes, and at least one explosive substance in contact with said conductor, said conductor being chemically neutral with respect to said substance, said gap having slanting edges.

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