PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Electric Detonators

We, NOBEL-BOZEL, a Body Corporate organised under the Laws of France, of 67, Boulevard Haussmann, Paris 8 éme, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement: —

The present invention relates to electric detonators.

The conventional electric detonators used at present for priming explosive charges generally comprise three essential parts, namely an electric fuse head, a priming explosive charge and an additional explosive charge the detonation of which is caused by the explosion of the preceding charge.

The electric fuse head mainly comprises a fine electric filament, welded to the ends of two copper rods connected, in their turn, to two electric current supply leads.

This filament is coated with an igniting composition which ignites when the filament becomes incandescent due to the passage of an electric current.

The ohmic resistance of the filament and of its supply leads is of the order of 1 to 2 ohms.

The intensity of the current usually employed for igniting such igniting compositions is of the order of 300 to 400 milliamperes.

The priming explosive charge is responsive to shocks, and its explosion is caused by the ignition of the aforesaid igniting composition. This charge mainly comprises mercury fulminate, lead nitride or tri-resorcinate, etc. and its weight is of the order of half a gram.

The additional explosive charge the detonation of which is caused by the explosion of the preceding charge supplies to the detonator the required power.

This charge comprises mainly trolite, melinite, tetryl, penthrite, and so on. In conventional electric detonators, the weight of this additional charge is of the order of 1 to 2 grams.

The manufacture of these electric detonators is very delicate, in particular due to the complexity of the electric fuse head, which necessitates the use of a delicate and costly manufacturing equipment and the high sensitivity to shocks of the priming explosive of the detonator.

The result is a high cost price and severe constraining conditions in particular in regard to the manufacturing plants for such detonators, the installations necessary for the stocking thereof, their transport and their use.

According to the invention an electric detonator is formed by a tube of electrically conductive material containing an explosive charge and acting as an electrode and an electrically conductive rod partially immersed in the charge and forming a second electrode. The charge comprises a mixture of a detonating explosive and an auxiliary conducting material and is of a nature such that a low voltage current will be conducted therethrough no matter what is the length of the path through the mixture between the electrodes.

The explosive compositions to be used in the detonators as defined above must be such that they are of reduced sensitiveness to shocks, they are good conductors of electric current and they detonate under the action of the electric current passing therethrough. In this connection the magnitude of the voltage to be employed in exploding the detonators of the invention will be of the order of 4 volts.

The explosive compositions according to the invention belong to a known class of explosives which are made conducting by the incorporation of suitable proportions of carbon, of metal powder or pigments.

As examples of explosive materials useful for the manufacture of explosive compositions according to the invention, reference is made to the complexes obtained by reacting solutions of metal salts of oxidizing acids: —

With hydrazine hydrate;

With semi carbazide;

With oxiamines.

[*Price 3s. 6d.*]

Price 25p

The present invention will be better understood from the following description in conjunction with the accompanying drawing showing diagrammatically an example of a detonator according to the invention.

The detonator shown on said drawing is essentially constituted by a cylindrical tube 1 made of a conducting material such as copper and comprising a flat bottom 2.

This tube is provided with a plug 3 made of an insulating material and closing in an airtight manner, through the medium of any suitable device 3a, the open upper end of the said tube 1.

A rod 4 made of a conducting metal (brass for example) suitably passes through this plug 3, along the axis thereof.

In the form of embodiment shown in the drawing, the rod 4 and the tube 1 itself constitute electrodes, the rod 4 being connected by any suitable means to an electric lead 5 and the tube 1 to a second electric lead 6. These leads 5 and 6 are preferably welded, the one to the end of the rod 4, the other to the tube 1. The detonator thus formed is filled with the explosive material 7 according to the invention, as defined hereinafter in a purely explanatory manner with reference to the examples to be given later. The rod 4 extends into the mass of explosive material 7.

An explosive composition for use in a type of detonator as described above can advantageously be obtained by reacting a 40% aqueous solution of hydrazine hydrate with a 30% aqueous solution of nickel nitrate. To this end, the two solutions are cold-mixed with moderate stirring. The precipitate which forms is dehydrated and then washed with methanol or ethanol, to remove the excess hydrazine. After drying and reduction of the lumps, there is obtained a very fine non hygroscopic powder of rose-violet colour.

These explosive materials are mixed with suitable proportions, of the order of 5 to 30% of carbon, such as lamp black, of graphite or metal powders or pigments such as bronze or aluminium.

The explosive composition thus obtained satisfies the desired characteristics in accordance with this invention, i.e. it is little sensitive to shocks, when suitably compressed or agglomerated, it exhibits a good electric conductivity and it detonates in a regular manner when electric currents having an intensity of about 100 to 300 milliamperes pass therethrough.

EXAMPLE 1

To 70 parts by weight of the complex prepared as described above are incorporated 30 parts of aluminium in the form of small flakes and this mixture, hereinafter called "HNA30" is homogenised by a rough kneading operation.

The "HNA30" composition is placed in the cylindrical tube 1 and is suitably compressed therein.

The electric leads 5 and 6 are similar to those used for conventional electric detonators, such as copper wires of 0.5 mm diameter, insulated by any appropriate means.

The ohmic resistance of the detonator thus produced, as measured with a magneto ohmmeter, is 20 ohms.

When the two leads 5 and 6 of the detonator according to the invention are connected to the terminals of a 2-volt lead accumulator the detonator immediately explodes.

The same effect is obtained with a simple pocket lamp battery of 4.5 volts.

EXAMPLE 2

A cylindrical cavity having a diameter of 7 to 8 mm and a length of 25 to 30 mm is made along the axis of a cartridge containing plastic dynamite and stripped at one of its ends, with the help of a brass point.

By means of a small funnel, this cavity is filled with the "HNA30" pulverulent composition which is roughly compressed with a brass tamper.

Two conducting brass blades 3 mm wide and 1 mm thick are introduced into the "HNA30" composition, said blades being maintained 3 mm apart by a distance piece made of insulating material.

When the two electric leads welded to these two conducting blades are connected to the terminals of a 12-volt lead accumulator the "HNA30" composition explodes immediately as well as the cartridge of dynamite ignited thereby.

The manufacture of detonators according to the invention is simple and therefore not costly and also safe in view of the low sensitivity to shocks of the explosive compositions used.

For this same reason, these detonators can be kept in stock, transported and used without the severe restraining conditions which are imposed on conventional electric detonators.

The electrical conductivity characteristics of the detonators according to the present invention are such as to enable them to be used under the same conditions and with the same exploders as conventional electric detonators and their advantage from the commercial standpoint is mainly due to their very reduced manufacturing cost.

WHAT WE CLAIM IS:—

1. An electric detonator wherein a tube of electrical conductive material contains an explosive charge and acts as one electrode and an electrically conductive rod is partially immersed in the charge and forms a second electrode and wherein the charge comprises a mixture of a detonating explosive and an auxiliary conducting material and is of a nature such that a low voltage current will be conducted therethrough no matter what is the length of path through the mixture between the electrodes.

2. An electric detonator according to Claim

1, wherein the conducting rod is located at or near the centre of a conducting tube of large diameter, said tube being capable of being charged with a mass of detonating explosive having a substantial thickness between the two electrodes.

3. An electric detonator according to Claim 1, wherein the detonating explosive consists of an organic or inorganic compound formed from a metal such as nickel or copper, and an oxiding mineral acid, such as nitric, chloric, perchloric acids, and at least one compound such as hydrazine, semi-carbazide or an oxiamine having included in its molecule a nitrated functional group N, linked to a group $-NH^2$ or to a hydroxiled hydrocarbonated radical.

4. An electric detonator according to Claim 1 or Claim 2, wherein the auxiliary conducting material constitutes from 5% to 40% of the charge.

5. An electric detonator according to Claim 4 wherein the auxiliary conducting material is of a material capable of forming a complex combination with the detonating explosive.

6. An electric detonator according to Claim 4 or Claim 5 wherein the auxiliary conducting material is aluminium.

7. An electric detonator substantially as described herein with reference to the accompanying drawing.

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1 SHEET

This drawing is a reproduction of the Original on a reduced scale.