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ELECTRIC EXPLOSION INITIATOR

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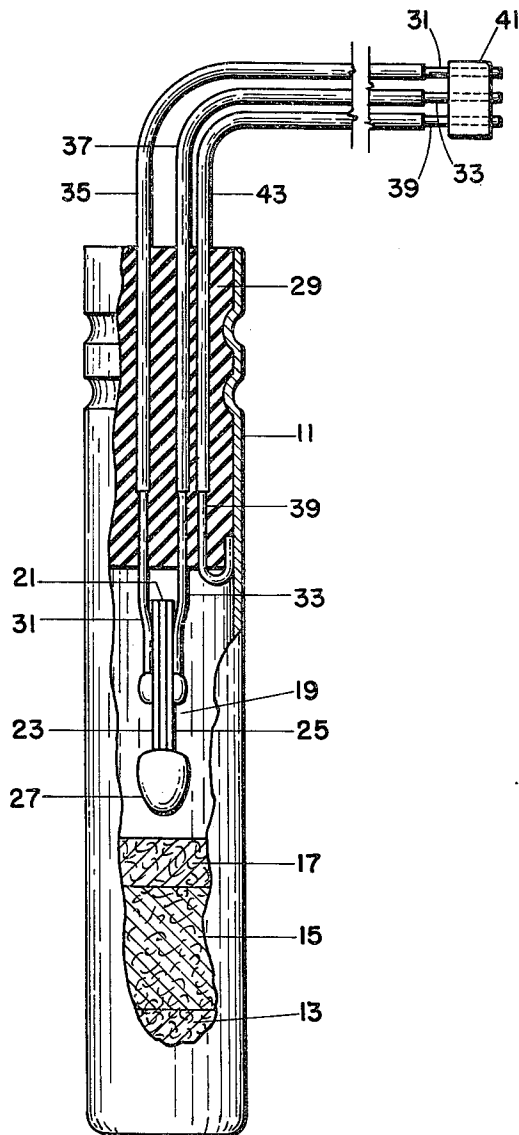


FIG. 1

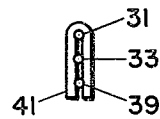


FIG. 2

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ELECTRIC EXPLOSION INITIATOR

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3 Claims. (Cl. 102-28)

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The present invention relates to electric explosion initiators.

An object of the invention is the provision of an improved electric explosion initiator which is resistant to static electric discharges.

Another object of the invention is the provision of an electric explosion initiator which is resistant to ground or stray currents.

A further object of the invention is the provision of an electric explosion initiator the firing time of which may be readily determined.

Still another object of the invention is the provision of an electric explosion initiator which may be readily tested for grounded firing circuits.

A still further object of the invention is the provision of a method for determining time of firing of an electric explosion initiator.

Other objects of the invention will be apparent from the following description.

Electric explosion initiators, such as electric blasting caps, usually include a metal shell into which is charged an explosive material, a firing circuit insulated from the shell and including insulated leg wires and a bridge wire, and an ignition composition in contact with at least the bridge wire portion of the firing circuit. In operation of the initiators an electric current is passed through the bridge wire and heats the bridge wire to a point where an ignition composition fires and the initiator is exploded.

One type of firing circuit which has found considerable use includes the electric match. An electric match customarily includes two elongated metal terminal sheets separated by insulating material and electrically connected by means of a bridge wire. The terminal sheets form tabs to which leg wires are electrically connected, and a match head is formed around the bridge wire portion of the match by coating it with ignition composition.

The bridge plug type of firing circuit is another one which is often employed. Bridge plug circuits comprise two insulated leg wires leading through a spacing plug and connected by a bridge wire. The bridge wire is then either enclosed by a loose ignition composition or by a dried paste.

For some time it has been recognized that electric explosion initiators may explode prematurely if sufficient static electric charges accumulate and pass between the firing circuit and the initiator shell through the ignition composition.

It has been proposed to protect electric ex-

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plosion initiators from static electric discharge between firing circuit and shell by grounding one side of the firing circuit inside the initiator to the shell. Although this construction may provide excellent resistance against static discharges it is subject to a very serious objection in that, since each initiator shell is grounded, it provides a perfect arrangement for current leakage from shell to shell through the earth when a number of initiators are connected in a series. Current leakage will cause misfires of such initiators as do not receive a sufficient proportion of the firing current. Misfires are of course very objectionable in blasting operations and are dangerous to remedy once they have occurred.

Ground or stray current protection is usually obtained by shunting the free ends of initiator leg wires until they are to be fired. This protection is not complete in the case of grounded leg wires.

According to the present invention an electric explosion initiator is provided which contains, in addition to a firing circuit, a third wire which is grounded to the shell. This third wire may be connected to the firing circuit at a point outside the initiator and preferably shunted with the leg wires of the firing circuit.

The invention will be further described in connection with the drawings which illustrate a specific embodiment and in which:

Figure 1 is a side view, partly in section, of an electric blasting cap of the invention, and

Figure 2 is an end view of the shunted wires of the cap of Figure 1.

11 represents a metal shell into the bottom of which are pressed base charge 13, primary detonator charge 15, and flash charge 17. The particular composition and number of these charges is no part of the present invention, but for purpose of illustration it may be stated that base charge 13 may be tetryl, the primary detonator charge 15 may be nitromannite, and the flash charge 17 may be a mixture of nitromannite and diazo di-nitrophenol. 19 represents generally a conventional electric match made up of insulating sheet 21 on each side of which are affixed metal terminal sheets 23 and 25. 27 represents an ignition composition, such as for example, a nitrocellulose lacquer containing copper acetylide surrounding the lower portion of terminal sheets 23 and 25 and a bridge wire connecting them (not shown). 29 represents a sealing plug which may, for example, be made of rubber. Connected to match head

19 and extending through plug 29 are leg wires 31 and 33 covered by insulation 35 and 37 respectively. Also extending through plug 29 is wire 39 covered with insulation 43. It will be noted that wire 39 is bent around the bottom of plug 29 so as to insure its being in contact with shell 11. The ends of leg wires 31 and 33 and wire 39 are connected together by means of a metal shunt 41.

Any suitable means may be employed to shunt the three wires, 31, 33, and 39, together. Merely twisting together is usually sufficient; however, it is generally found convenient to use a metal shunt.

In the cap of the invention the electrical connection between the firing circuit and the cap shell provides static protection such as may be obtained by grounding one leg wire against the shell. However, since the wire which is connected to the shell may be disconnected from the firing circuit when the initiator is to be fired no problem of current leakage such as exists with initiators in which the firing circuit is grounded to the shell exists.

Also the fact that the shell is connected directly with the shunted end of the leg wires in accordance with the present invention the stray current danger is very considerably reduced. While an initiator having a grounded firing circuit and shunted leg wires offers considerable protection against stray currents, there is always the possibility that a stray current reaching the firing circuit from the initiator shell may divide and go partially through the ignition composition and detonate the cap. When the shell is connected directly to the shunt and the firing circuit insulated from the shell except through the shunt, as in the present invention, no such division in current is possible.

Initiators of the present invention will also be found to be particularly valuable in testing initiators for grounded firing circuits by connecting a blasting galvanometer between the firing circuit and the shell wire. Occasionally in manufacture or handling, electric explosion initiator firing circuits become grounded to the shell walls and it is desirable to have a ready means for testing for such grounds. In ordinary use of the initiators of the present invention the shell wire is maintained connected to the leg wires until the initiator is to be connected to the firing means or to be tested. When an initiator is to be used in series with several other initiators it is desirable that the shell wires of all the initiators be connected together or to a common trunk line, and the common trunk line kept connected to the leads to the series until final firing connections are made.

In this way if a series of electric explosion initiators must be left for a period of time such as overnight and exposed to electrical storms, the firing circuit and the shell walls are maintained so that one cannot become charged to a different potential than the other.

The time of firing of the electric explosion initiators of the present invention may readily be determined. This feature is of particular advantage in seismograph work. To determine the time of firing a potential is imposed across a wire of the firing circuit and the shell wire. Since there is no connection in the cap between the shell and the firing circuit no current will ordinarily pass. However, when the initiator ex-

plodes ionization takes place in the cap and will permit current to pass between the firing circuit and the shell. Passage of this current can be recorded by suitable means, for example an oscillograph, to record the time of firing of the initiator.

It is desirable but not necessary that the shell wire be insulated in a similar manner to the leg wires, and it is also desirable that the shell wire be marked so that it will not be confused with the usual leg wires. This may be suitably done by providing the shell wire of a different size or with insulation of a different color.

Conveniently the shell wire and the two leg wires may be bound together or in the case of plastic wire extruded together to provide a convenient or rugged assembly.

If it is desirable to use the third wire, other than the leg wires, merely for the purpose of determining the time of firing of the initiator as outlined above, it is not necessary that the third wire be in electrical contact with the shell; it may simply terminate inside the initiator so as to provide a pole for passage of current through the ionized atmosphere inside the cap. However, when the wire is connected with the initiator shell, as is preferred, a larger contact is of course provided.

What is claimed is:

1. An electric explosion initiator comprising a metal shell, an explosive composition, a firing circuit including two insulated leg wires electrically connected in the shell by a bridge wire, and a third wire leading into the initiator and being electrically insulated from the firing circuit in the initiator, said three wires being electrically connected outside of said initiator by a removable shunt path of low resistance.

2. An explosion initiator comprising a metal shell, an explosive composition, a firing circuit including two insulated leg wires, said firing circuit being electrically insulated in the initiator from said shell, and a third wire connected to said metal shell, the said three wires being electrically connected outside of said initiator by a removable shunt path of low resistance.

3. An explosion initiator comprising a metal shell, an explosive composition, a firing circuit including two insulated leg wires, said firing circuit being electrically insulated in the initiator from said shell, and a third wire leading into the initiator and connected to said shell, the said three wires being electrically connected outside of said initiator by a removable shunt path of low resistance.

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