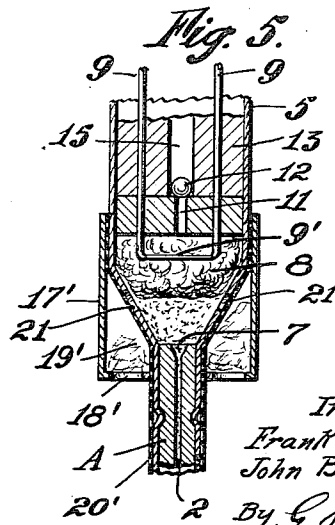
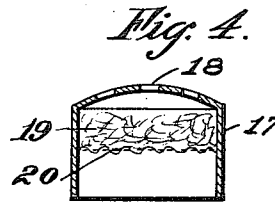
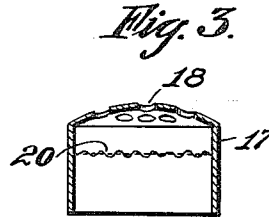
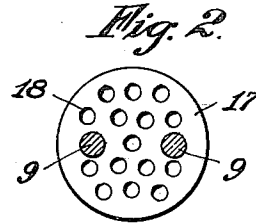
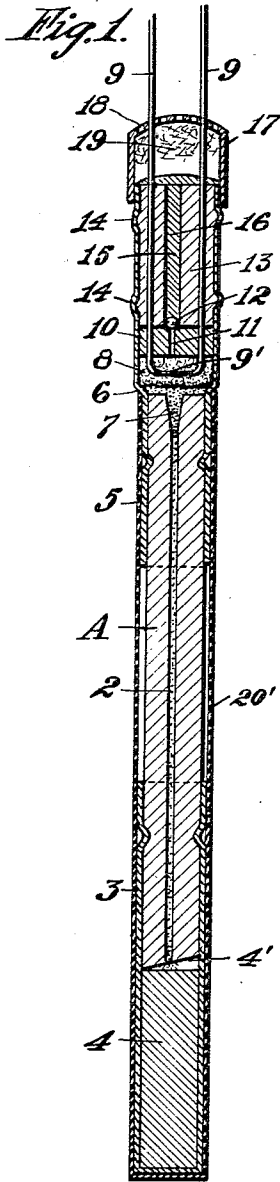


F. BERNARDI & J. B. SAUVE.
 DELAY ACTION EXPLODER.
 APPLICATION FILED OCT. 21, 1911.

1,029,261.

Patented June 11, 1912.



Witnesses:

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UNITED STATES PATENT OFFICE.

FRANK BERNARDI AND JOHN B. SAUVE, OF MOKELUMNE HILL, CALIFORNIA, ASSIGNORS TO PATENT ELECTRIC FUSE SPITTER CO., OF MOKELUMNE HILL, CALIFORNIA, A CORPORATION OF CALIFORNIA.

DELAY-ACTION EXPLODER.

1,029,261.

Specification of Letters Patent.

Patented June 11, 1912.

Application filed October 21, 1911. Serial No. 655,875.

To all whom it may concern:

Be it known that we, FRANK BERNARDI and JOHN B. SAUVE, both citizens of the United States, residing at Mokelumne Hill, in the county of Calaveras and State of California, have invented new and useful Improvements in Delay-Action Exploders, of which the following is a specification.

This invention relates to a delay action exploder or time fuse, such as is employed in blasting operations.

It is the object of this invention to provide a delay action exploder or time fuse which is so constructed that it will explode to set off a blasting charge at a time subsequent to the moment of ignition of the fuse; in which the length or lapse of time between the moment of ignition and the moment of explosion is governed by the length of the fuse; and which is so arranged as to be ignited by the action of an electric current.

Delay action exploders or fuses of the above character are employed in mining and blasting operations, and are usually arranged in series in variously positioned charges or blasts, and are connected to an electrical conductor, through which a current is sent to light the fuses in the series simultaneously. The fuses are of various lengths or "times," when it is desired that they explode successively to set off the charges at suitable intervals, and are equally timed when they are to explode simultaneously; in either event the explosion taking place some time after the ignition of the fuse. Great trouble has been experienced in the use of electrically ignited time fuses, by reason of premature explosions or burning of the blasting charge, occasioned by back-firing of the fuse into the explosive material in which it is embedded.

It is the purpose of this invention to obviate this trouble, which is accomplished by so constructing the ignition end of the fuse that the flames or sparks emitted by the burning fuse will not come into contact with the explosive charge, but which will permit of the escape of the gases or products of combustion arising from the burning fuse so as to insure an even fire.

Other objects will become apparent hereinafter.

The invention consists of the parts and the construction and combination of parts, as hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Figure 1 is a vertical section of the invention. Fig. 2 is an enlarged end view of same. Figs. 3, 4, and 5 are details showing modified forms of the flame filter.

In the drawings, A represents a cylindrical fuse, consisting of wound layers, of tape or the like, formed with a perforation extending longitudinally therethrough, which perforation is designed to be filled with meal powder or the like, indicated at 2. A metallic sheath 3 is crimped or otherwise secured to one end of the fuse A and forms a receptacle for an explosive substance 4, such as fulminate of mercury or the like, forming a cap, by the explosion of which the actual explosion of the blasting charge is effected; the explosive 4 being preferably in solid form and spaced a short distance from the end of the powder core 2 to form an air space 4'. The end of the fuse is cut at an angle, so that when it is inserted in the sheath 3, its long edge will contact the explosive 4, as shown, so as to form the air space 4', the provision of which insures the ignition and explosion of the explosive 4. The other end of the fuse is fitted with a metal ferrule 5 which is secured to the fuse so as to form a watertight joint by crimping or otherwise. The ferrule 5 extends some distance beyond the end of the fuse and is slightly enlarged, beyond the point of juncture with the fuse to form a shoulder 6, and at the same time increase its capacity. The end of the fuse A within the ferrule 5 is split a short distance to form a pocket or recess for the reception of a small quantity of quick fire powder, as indicated at 7; this quick fire powder contacting or forming part of the powder core 2 in the fuse and extending over the upper end of the fuse. The purpose of this pocket of quick fire powder at this point is to insure the ignition of the core 2 when the fuse is lighted, as will presently be described.

Guncotton, or other suitable, highly inflammable material, is disposed within the ferrule 5 adjacent the quick fire powder on the end of the fuse, as shown at 8, with which a small quantity of the quick fire powder is mingled.

A pair of insulated electrical conductors 9—9 of any suitable length is mounted in a plug 10 formed of sulfur or similar material, and extending therethrough a short distance, are connected together by means of a platinum wire or bridge 9', which, when the plug 10 is inserted in the ferrule 5, as shown, will be embedded in the guncotton 8. The plug 10 is formed with a central perforation 11 of small diameter, which is closed by means of a shot or wad 12 at its upper end to form an air space in the perforation adjacent to the guncotton; the air contained in this space facilitating the ignition and explosion of the guncotton.

A sulfur plug 13 is formed in the outer end of the ferrule 5, so as to embed a section of the conductors 9, the plug 13 being formed by pouring molten sulfur into the open end of the ferrule around a central core. Annular grooves 14 are formed in the ferrule, into which the molten sulfur will run and when the latter hardens, prevent the plug thus formed from working or falling out of the ferrule. The central core being removed, a perforation 15 is formed, which perforation extends longitudinally through the plug 13 centrally thereof and communicates with, and is larger in diameter than, the perforation 11 in the plug 10, so that a seat will be formed for the shot or wad 12, which is then dropped into position through the perforation 15.

A soft wax or grease plug 16 is formed in the perforation 15 by pouring a suitable wax, grease, or composition into the outer open end thereof, which plug is designed to form a water and air-tight seal above the shot or wad 12; the latter acting to prevent the wax from coming in contact with the guncotton 8. The end of the sulfur plug 13 is covered with the wax 16, as is the joint between the plug and the ferrule 5, so as to form a waterproof seal at this point.

Mounted on the outer end of the ferrule 5 is a hood or dome 17, which is provided on its end portion with a series of small holes or perforations 18. The end portion of the dome 17 is spaced some distance from the end of the ferrule 5 and plug 13 and is designed to contain a small quantity of asbestos fiber 19 or a like material which is sufficiently loose to permit of the passage of air therethrough, but of such compactness as to prevent flames from passing through the perforations 18 when the fuse is ignited, as will be later described. A fine wire screen or gauze 20 may be employed in lieu

of the asbestos fiber, if desired, as shown in Fig. 3, or may be used in conjunction therewith, as shown in Fig. 4.

The electrical conductors 9—9 pass through the dome 17 and are adapted to be connected at their outer ends to any suitable source of electrical supply which may be regulated and controlled in any suitable manner.

The fuse A is inclosed in a casing 20' which extends over the sheath 3 and is attached at its upper end to the ferrule 5 adjacent to the shoulder. The casing 20' may be formed of any suitable material, in some instances metal tubing being employed, whereas in other cases a rubber tube is used which is dipped in paraffin or other wax to render it impervious to water. The casing 20' together with the wax plug 16 act to prevent moisture from reaching the fuse when it is submerged in water, as is frequently the case in mine work.

In the application of this invention, the device composed of the parts enumerated, is placed in the charge of explosive, such as dynamite or nitro-glycerin, to be exploded, and the wires 9—9 are attached to a suitable source of electric supply. An electric current being caused to flow through the conductors 9—9, heats the platinum wire or filament 9' to such an extent that the guncotton 8 will be ignited and exploded, which acts to set fire to the meal powder 7 on the end of the powder core 2, so as to light the latter, and at the same time blows the shot or wad 12, together with the wax plug 16, out of the longitudinal bore 15 of the plug 13 into the space within the hood 17 between the end of the plug 13 and the asbestos screen 19. The opening of the bore 15 forms a vent for the gases formed by the burning core 2, which gases pass through the asbestos screen 19 and the perforated hood 17; the screen acting to prevent the escape of the flames or sparks which are confined within the hood. This prevents the ignition of the explosive material in which the exploder is embedded and is particularly advantageous where black powder is being used.

When the core 2 has burned to the explosive materials 4 in the sheath 3, these materials are ignited and caused to explode so as to set off the explosive in which the exploder is placed. In the event black powder or other explosive adapted to explode by the action of a flame instead of percussion, is used, the cap composed of the sheath 3 and explosive 4 may be dispensed with.

From the foregoing it will be seen that we have produced a delay action exploder which is simple in construction, efficient, safe and reliable.

If desired, perforations 21 may be formed

in the ferrule 5, as shown in Fig. 5, adjacent the space occupied by the guncotton 8, and a hood 17' having perforations 18' and containing loose asbestos 19' or other screen, placed over the perforations 21. The rubber jacket 20' is carried over the perforations 21 to exclude moisture; this rubber blowing away when the guncotton 8 is exploded, as before described. In this case the gases will escape through the filter or screen 19' out the perforations 18. This arrangement may be employed in conjunction with the hood 17, or the latter may be dispensed with if desired.

Having thus described our invention, what we claim and desire to secure by Letters Patent is—

1. The combination with a fuse, of a female member thereon having a chamber to contain an inflammable substance, said chamber having a vent for the gases generated by the ignition of said substance, electrical means for firing said substance, and a perforated cap inclosing a chamber into which the vented gases from the first-named chamber exhaust before being released to the atmosphere, to prevent premature explosion.

2. The combination with a fuse, of a female member thereon, having a chamber to contain an inflammable substance, said chamber having a vent for the gases generated by the ignition of said substance, electrical means for firing said substance, a perforated cap inclosing a chamber into which the vented gases from the first-named chamber exhaust before being released to the atmosphere, to prevent premature explosion, and a fireproof filtering material in said cap.

3. A delay action exploder comprising a fuse, a ferrule attached to one end of the fuse, an explosive in the ferrule adjacent to the fuse, a filament embedded in the explosive, an electrical conductor attached to each end of the filament, a plug in which the conductors are mounted arranged in the ferrule adjacent to the explosive, a perforation in said plug extending lengthwise and centrally thereof, to form an air space, an auxiliary plug formed in the outer end of the ferrule for holding the first named plug in position, a perforation extending lengthwise through said plug registering with the perforation in the first named plug, a wad for closing the first named perforation, and a grease filling in the last named perforation above the wad.

4. A delay action exploder comprising a fuse, a ferrule attached to one end of the fuse, an explosive in the ferrule adjacent to the fuse, a filament embedded in the explosive, an electrical conductor attached to each end of the filament, a plug in which the con-

ductors are mounted arranged in the ferrule adjacent to the explosive, a perforation in said plug extending lengthwise and centrally thereof, to form an air space, an auxiliary plug formed in the outer end of the ferrule for holding the first named plug in position, a perforation extending lengthwise through said plug registering with the perforation in the first named plug, a wad for closing the first named perforation, a grease filling in the last named perforation above the wad, and means formed in the ferrule for retaining the last named plug therein.

5. A delay action exploder comprising a fuse, a ferrule attached to one end of the fuse, an explosive in the ferrule adjacent to the fuse, a filament embedded in the explosive, an electrical conductor attached to each end of the filament, a plug in which the conductors are mounted arranged in the ferrule adjacent to the explosive, a perforation in said plug extending lengthwise and centrally thereof, to form an air space, an auxiliary plug formed in the outer end of the ferrule for holding the first named plug in position, a perforation extending lengthwise through said plug registering with the perforation in the first named plug, a wad for closing the first named perforation, a grease filling in the last named perforation above the wad, means formed in the ferrule for retaining the last named plug therein, a perforated dome mounted on the end of the ferrule, and a flame filter in said dome.

6. A delay action exploder comprising a fuse, a ferrule attached to one end of the fuse, an explosive in the ferrule adjacent to the fuse, a filament embedded in the explosive, an electrical conductor attached to each end of the filament, a plug in which the conductors are mounted arranged in the ferrule adjacent to the explosive, a perforation in said plug extending lengthwise and centrally thereof, to form an air space, an auxiliary plug formed in the outer end of the ferrule for holding the first named plug in position, a perforation extending lengthwise through said plug registering with the perforation in the first named plug, a wad for closing the first named perforation, a grease filling in the last named perforation above the wad, means formed in the ferrule for retaining the last named plug therein, a perforated dome mounted on the end of the ferrule, a flame filter in said dome, and an explosive cap mounted on the other end of the fuse with an air space therebetween.

7. The combination with a fuse having an electric igniter, and means for venting the gases generated by the burning fuse, of an external vented hood for confining the sparks and flames occasioned by the ignition of the fuse to prevent backfiring.

8. The combination with a fuse having electric igniter, and means for venting the gases generated by the burning fuse, of means for confining the sparks and flames occasioned by the ignition of the fuse to prevent backfiring, comprising a perforated dome arranged over the vent, and a flame filter in the dome.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses. 10

FRANK BERNARDI.
JOHN B. SAUVE.

Witnesses:

FRANK J. SEIBEL,
CHARLES P. VICINI.
