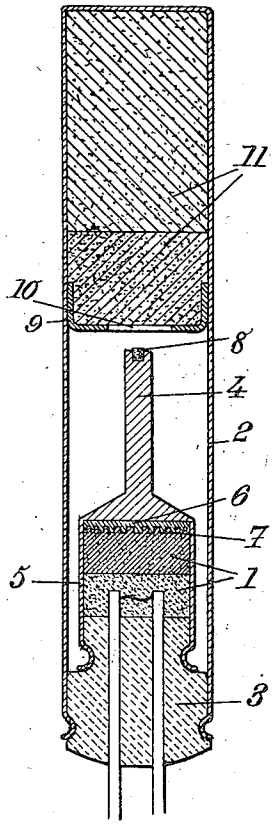
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DELAY ACTION BLASTING CAP

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DELAY ACTION BLASTING CAP

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The present invention relates to delay action blasting caps, that is to say to devices of this kind including an ignition charge and a detonating charge, same as means for causing the second one to be brought into action by the first with a certain delay, of predetermined value, in particular in such manner as to permit of ensuring, by simultaneous operation of several blasting caps having suitably chosen different delays, successive explosions at given intervals, as desired for instance in mining, quarrying and analogous operations.

The chief object of my invention is to provide a device of this kind which is better adapted to meet the requirements of practice than those obtained for the same purpose up to the present time, especially from the point of view of precision.

A preferred embodiment of my invention will be hereinafter described with reference to the accompanying drawing, given merely by way of example, and in which the only figure is a diagrammatic sectional view of a blasting cap made according to my invention.

It should first be reminded that, in existing devices of the kind in question, the connection between the ignition charge and the detonating charge is most generally obtained by means of a fuse or any other analogous body or device the combustion of which is produced by the firing of the ignition charge, this combustion corresponding to a variable time which constitutes the delay provided before the firing of the detonating charge.

Therefore, in devices of this kind, the delay is the time of combustion of a given intermediate body. But experience has taught that the precision with which this time of combustion can be determined is no longer sufficient for the requirements of practice. It becomes more and more necessary to provide series of blasting caps having delays which differ from one another by very small fractions of a second, which cannot be obtained by means of fuses such as above referrred to.

According to the present invention, in order to obtain the maximum of precision, the connection between the ignition charge and the detonating charge for firing the latter, instead of being ensured by the combustion of an intermediate body is ensured by heat conductivity through at least one suitable medium.

The delay then corresponds to the time necessary for the propagation of heat through this medium.

Preferably, I provide means for obtaining a substantially constant value of the temperature

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t_1 produced by the combustion of the ignition charge, whereby the delay R is determined, as accurately as possible by a formula such as the following one:

$$R=\frac{K}{t_1-t_2}$$

in which t_2 is the temperature of the surrounding atmosphere, and K a coefficient which is variable according to the matter, the shape and the dimensions (cross section, length, etc.) of the intermediate medium through which the calories are propagated.

The blasting cap, considered as a whole, and apart from the means for interconnecting the two charges above mentioned, may be of any suitable conventional construction. For instance the ignition charge I is located at the base of a brass tube or the like 2, provided with a plug 3 through which pass the electric wires provided for firing the charge. The detonating charge II is provided at the other end of the tube, with an interval between charges I and II intended to contain the interconnecting means above referred to.

The charges may be made in any known manner, charge I consisting of a composition of matter capable of giving off a great amount of heat in a very short time, preferably with a minimum production of gases (although this condition is not absolutely necessary), whilst charge II is constituted by a known explosive.

The interconnecting means in question are for instance constituted by a rod, such as 4, intended to transmit heat. This rod is therefore advantageously made of a metal which is a good conductor of heat (copper, brass, steel, etc.), although other materials may be utilized which are more or less good heat conductors, according to the value of the delay R to be obtained.

At the end of this rod that corresponds to the ignition charge, means are provided for ensuring a good transmission of heat from said charge to said rod, said means including for instance a kind of socket 5 carried by rod 4 (integral with said rod in the embodiment illustrated by the drawing) and adapted to contain the ignition charge I. This socket, which is for instance secured on plug 3, can be calculated to resist the stresses that are produced when the charge is fired (due in particular to the disengagement of gases) in order to avoid any projection of hot gases or flames before the explosion of the detonating charge, so as to comply with the safety regulations provided in the mining industry.

If it is desired to have a temperature t_1 that remains substantially constant, I may provide means making use of a physical phenomenon tending to keep the temperature at a constant value during the combustion of the charge. For instance, I may utilize the latent heat of fusion of a suitable body.

Thus the thermic powder which constitutes said charge may be mixed with tin in powdery or any other suitable form, or any other body having a well defined melting point.

This body may be either distributed through the whole mass of the ignition charge or, on the contrary, concentrated at certain points, for instance at the bottom of socket 5, as shown at 6. In this latter case, the layer 6 of tin and the matter of the ignition charge 1 are preferably arranged so as to penetrate each other by means of teeth such as 7 in order to ensure an intimate contact between them. The temperature then reaches, at the time of combustion, the melting point of layer 6 and tends to keep at this value.

At the other end of rod 4, means are provided for ensuring, under the effect of the transmission of heat through said rod, the firing and deflagration of this charge, said means consisting, for instance, of a fulminating element 8 fitted either at the end of rod 4 or at the adjacent end of detonating charge 11. This charge 11 bears against a partition 9 provided with a wall 10.

Means may be provided for ensuring a heat insulation around rod 4, this result being obtained, in the embodiment shown by the drawings, by the mass of air which surrounds this rod.

With an arrangement such as above described, when the firing of the ignition charge is obtained by passage of electric current through the filament, a certain amount of calories is produced by the combustion of this charge, and these calories tend to propagate themselves along rod 4. After a certain time, which depends upon the characteristics of said rod, a sufficiently high temperature is obtained at the end of this rod for causing fulminating element 8 to explode and to produce the explosion of the detonating charge.

The transmission of heat through rod 4 can be calculated in an extremely accurate manner as a function of various factors which can be modified at will, to wit:

a. The nature of the metal or other material of which this rod is made;
b. The cross section area of this rod;
c. Its shape; and
d. Its length.

These various factors make it possible to determine the above mentioned coefficient k.

I can also vary the initial temperature t_1 by suitably choosing the quality and composition of the powder that is used for constituting the ignition charge.

It is therefore possible to obtain any desired series of blasting caps having time delays that differ from one another by extremely small values.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be

changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

What I claim is:

1. A delay action blasting cap which comprises, in combination, an ignition charge, a detonating charge at a distance from said ignition charge, a piece of a heat conducting incombustible material extending between said two charges with one end in intimate contact with said ignition charge and the other end at a distance from said detonating charge, and a fulminating element carried by said last mentioned end of said piece and out of contact with said detonating charge.

2. A delay action blasting cap which comprises, in combination, an ignition charge, a detonating charge at a distance from said ignition charge, a metal rod extending between said two charges with one end in intimate contact with said ignition charge and the other end at a distance from said detonating charge, and a fulminating element carried by said last mentioned end of said piece and out of contact with said detonating charge.

3. A blasting cap according to claim 2 further including a casing surrounding the space between said ignition and detonating charges, and a gaseous atmosphere in said space around said rod.

4. A delay action blasting cap which comprises, in combination, an ignition charge, a detonating charge at a distance from said ignition charge, a piece of a heat conducting incombustible material extending between said two charges with one end in intimate contact with said ignition charge and the other end at a distance from said detonating charge, a fulminating element carried by said last mentioned end of said piece and out of contact with said detonating charge, and means for keeping the temperature of said ignition charge at a constant value during combustion thereof.

5. A delay action blasting cap which comprises, in combination, an ignition charge, a detonating charge at a distance from said ignition charge, a piece of a heat conducting incombustible material extending between said two charges with one end in intimate contact with said ignition charge and the other end at a distance from said detonating charge, a fulminating element carried by said last mentioned end of said piece and out of contact with said detonating charge, and a body having a well defined melting point added to said ignition charge for keeping the temperature thereof at a constant value during its combustion.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,093,353	Geitmann	Sept. 14, 1937
2,103,014	Palmieri	Dec. 21, 1937
2,185,370	Burrows et al.	Jan. 2, 1940
2,189,301	Smith	Feb. 6, 1940
2,370,159	Hanley	Feb. 27, 1945