May 14, 1946. W. M. COBB 2,400,103

DETONATOR OR BLASTING CAP

Filed April 16, 1941

Fig-1-

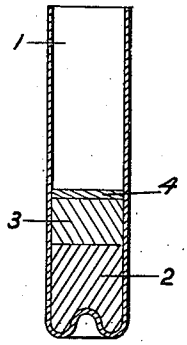


Fig-2-

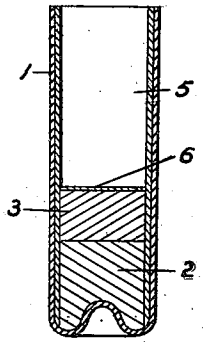


Fig-3-

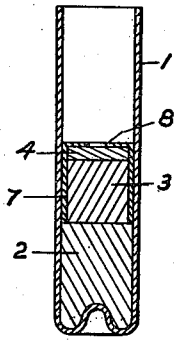


Fig-4-

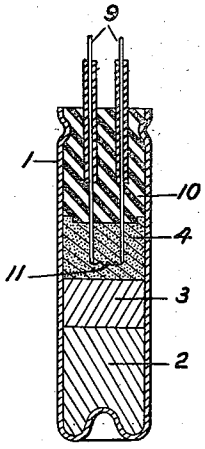


Fig-5-

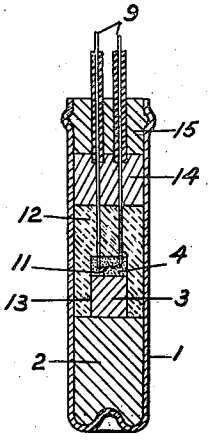


Fig-6-

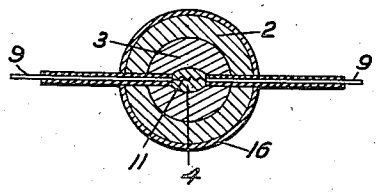
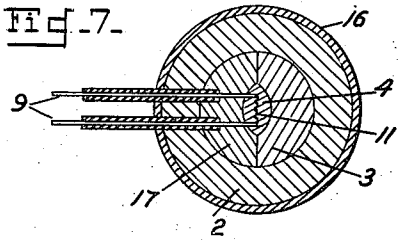


Fig-7-



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2,400,103

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DETONATOR OR BLASTING CAP

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Daytona Beach, Fla.

Application April 16, 1941, Serial No. 388,761

2 Claims. (Cl. 102—28)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to means for bringing about the detonation of relatively insensitive detonating explosive compounds as distinguished from devices of the type shown in U. S. Patent No. 2,123,691 wherein it is contemplated that the "non-violent" initiator be used only with deflagrating explosives.

In the employment of conventional blasting caps and detonators accidents have been frequent and many lives are lost each year as a result of the accidental mishandling of caps filled with sensitive compounds.

Explosives each of which have some desirable characteristics for use in detonators may be divided roughly into three groups:

First, compounds such as lead azide, fulminate of mercury, diazo-dinitrophenol and nitromannitol used to prime or initiate other explosives. Explosives in this group furnish the initiating ingredient of most commercial detonators and are sometimes called fulminating or cap compounds. Such compositions detonate on ignition and are extremely sensitive to blows and friction.

Second, compounds such as tetryl or P. E. T. N. (pentaerythritol tetranitrate) which are usually used as base charges in detonators and as booster charges for the priming of insensitive compounds and are sometimes known as booster compounds. Explosives of this class are moderately sensitive to blows, are fairly difficult to ignite, and will not usually detonate when ignition is produced by ordinary means. Usually they must be initiated by compounds of the first group.

Third, compounds such as trinitrotoluene, picric acid, and ammonium picrate, which are widely used as military demolition explosives and shell fillers. Compounds of this class are quite insensitive to shock, are difficult to ignite, and will usually burn without detonation when ignited in any normal manner. Conventionally they are exploded by a booster, which is initiated by a blasting cap or detonator.

Conventional blasting caps and detonators use one of the dangerously sensitive compositions of the first group as the initiating ingredient of their explosive mixture. Detonators are also known in which base charges from the second group or the more sensitive of those of the third group have been used in conjunction with initiators from the first group. However it is not thought that a successful blasting cap has heretofore been produced using a substance or a combination of substances all of the same order of sensitivity as those of the second or third groups.

It is an object of this invention to provide means of exploding insensitive compounds without requiring the use of dangerously sensitive initiators.

It is a further object of this invention to provide a novel form of detonator.

An ideal blasting cap would be one which could not ordinarily be exploded by accidental means. The initiating element should be very sensitive to heat or flame such as that produced by the "spit" of a safety fuse or from the fusing bridge wire or match head of conventional electrical fuse heads. At the same time it should be relatively insensitive to blows, crushing, shock, sudden penetration, or probing. Such an ideal detonator could be approximated if an initiating element could be obtained which had the heat and flame sensitiveness of the fulminating compounds and a sensitivity to shock comparable to that of shell filling explosives.

Although the explosives of the second and third groups will not usually detonate from heat or fire as ordinarily applied, the basic principle of this invention lies in my discovery that these explosives will detonate consistently and completely if intense heat is applied to them over an extremely short interval of time. To supply this intense heat I use substances which are not ordinarily considered explosive, or at least are no more sensitive than the explosives of the second or third groups. Such substances may be thermite, magnesium powder and barium peroxide, or other metallic powder and a suitable oxidizing agent.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment as shown in the accompanying drawing in which:

Figures 1, 2 and 3 are longitudinal sections of three modifications of the invention as applied to a blasting cap for safety fuse.

Figures 4 and 5 are similar views of embodiments of the invention as applied to electric detonators.

Figures 6 and 7 are longitudinal sections of two other forms of the invention.

As an explosive or base charge 2 I may use any one of the explosive compounds of the second or third group, for example, tetryl, P. E. T. N., T. N. T., picric acid, or ammonium picrate. In

close proximity to the base charge 2 I use a suitable heat producing charge 3 such as thermite or any suitable metallic powder and an oxidizing agent. Such substances are substantially non-explosive but combine to produce extreme temperatures in a very short interval of time. Some of these heat producing agents may be ignited reliably by conventional means, but where I use those which cannot be so ignited the use of an igniter charge 4 may be required. Such substances should be easily inflamed but should be chosen from among materials which will not increase the impact or abrasion sensitivity above the sensitiveness imparted to it by the base charge either by virtue of the inherent characteristics of the compound chosen or by virtue of the manner in which the compound is charged into the cap. For example nitrocellulose powder in granular form or in combination with suitable binding agents, colloided nitrocellulose, or mixtures such as that of selenium, barium peroxide, and nitrostarch may be employed as igniters.

Specifically Figure 1 represents a blasting cap for use with safety fuse in which 1 is a conventional shell of metal or other material and 2 the base charge of T. N. T. or the like. A suitable heat producing charge 3 is placed directly over the base charge and in contact with it. Retaining the heating charge in place and serving to ignite it is a wafer 4 of nitrocellulose, pressed in plastic form into the cap shell.

In some cases it is desirable to insulate the container from the heating charge to prevent the decomposition of the container before detonation of the base charge has taken place. Figure 2 illustrates one such expedient wherein the shell 1 is provided with an inner shell 5 of inert insulating material or is internally coated with a layer of ceramic or insulating material. The base charge 2 and heating charge 3 are loaded as in Figure 1. In this modification the heating charge is of the type which can be ignited directly by the spit of a safety fuse and may be retained in place by the application of nitrocellulose lacquer 6 or the like to the surface or by a perforated metal cap or thimble.

A similar expedient is illustrated in Figure 3. In this modification a thimble or cup 7 of ceramic or other insulating material is loaded with igniting charge 4 and heating charge 3 and pressed into the shell 1 being retained therein in contact with the base charge 2 by frictional engagement with the wall of the shell. The perforation 8 exposes the igniter composition 4 to ignition as by a safety fuse.

Figure 4 illustrates the application of the invention to an electric detonator of the bridge wire type. In this modification lead wires 9 are molded into a plug 10 and provided with a fusible bridge wire 11 in the well-known manner. The plug is crimped into a shell 1 with the bridge wire surrounded by an igniting charge 4, preferably in granular form.

Figure 5 illustrates the application of the invention to an electric detonator of the cavity plug type. In this modification the lead wires 9, having a fusible bridge wire 11, are sealed into a ceramic plug 12. This plug is so formed as to include a cavity 13 in which the igniter charge 4 and heating charge 3 may be loaded with consequent insulation of the shell wall from the heat generated. Sealing may be accomplished in any well-known manner, as by use of the sealing compound 14 and sulphur plug 15.

Obviously a match head or any other electric ignition device may be employed in the practice of the invention. It is also contemplated that the heating charge or a part thereof may be mixed with the base charge.

In the modification of the invention shown in Fig. 6 a substantially spherical detonator is formed by coating a bridge wire 11 with an igniting charge 4 and surrounding this with the heating charge 3. The base charge is then molded around the assembly and the assembly placed in a container or coated with a suitable protective substance 16. Any suitable binding materials may be used in molding the charges into the desired shapes.

Figure 7 shows a modification somewhat similar to that of Figure 6. In this modification the lead wires 9 are molded into a supporting plug 17 and provided in the usual manner with a bridge wire 11. The igniting composition 4 is molded about the bridge wire and the heating charge 3 is formed thereagainst. Surrounding the heating charge and plug is the base charge 2. The whole may be surrounded with a protective coating 16 as in Figure 6. A detonator of the form shown in Figures 6 or 7 in addition to the obvious advantage of its simplicity of construction will have the advantage that the detonation wave will be propagated uniformly in all directions rather than exhibiting the sharply directional effect of the conventional form of detonator. Further a detonator of this form, because of the complete enclosure of its priming charges within the insensitive base charge, would be much safer to handle than the conventional form even though more sensitive initiators were employed.

I claim:

1. In a substantially spherical electric detonator having an electric ignition device, an initiator molded on and concentric with said ignition device, a charge of detonating explosive formed about said initiator and concentric therewith and a protective coating enclosing the detonator.

2. In a substantially spherical electric detonator, a hemispherical plug of inert material supporting an electric ignition device, a hemispherical initiator charge formed against said plug, a detonating explosive formed about and concentric with said charge and plug and a protective coating enclosing the detonator.

WILLIAM M. COBB.