Nov. 29, 1938. W. E. KIRST 2,138,581

PRIMER FOR HIGH EXPLOSIVES

Filed Oct. 25, 1935 2 Sheets-Sheet 1

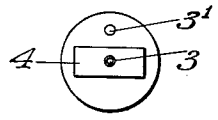


FIG. 1A

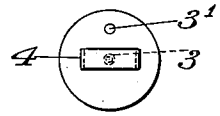


FIG. 2A

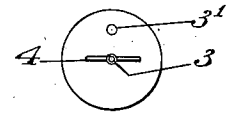


FIG. 3A

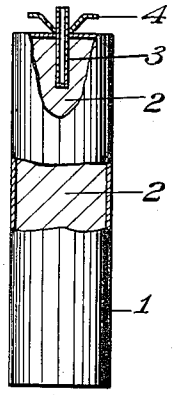


FIG. 1

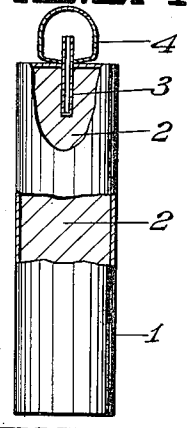


FIG. 2

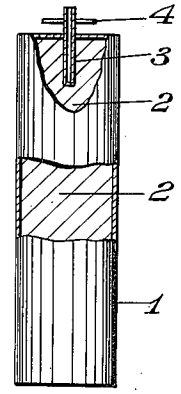


FIG. 3

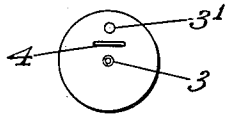


FIG. 4A

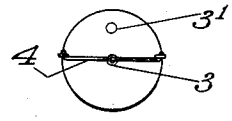


FIG. 5A

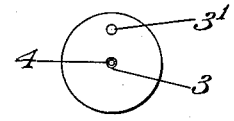


FIG. 6A

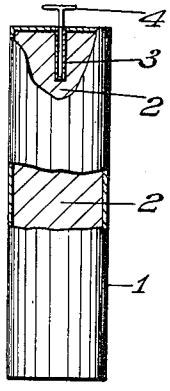


FIG. 4

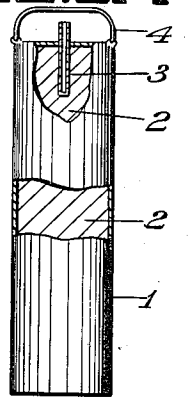


FIG. 5

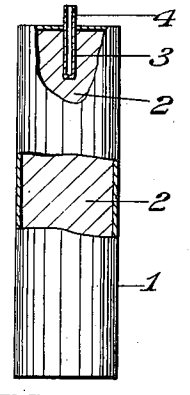


FIG. 6

William E. Kirst INVENTOR.

BY Fred Sherrod

ATTORNEY

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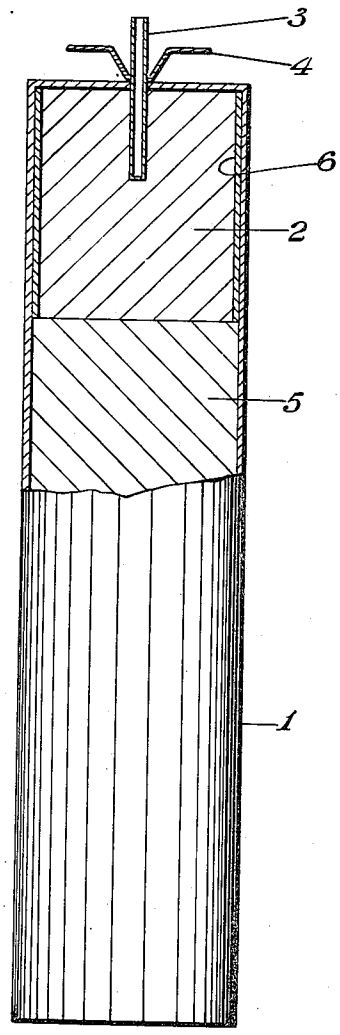


FIG. 7

William E. Kirst INVENTOR.

BY Fred Sleroos

ATTORNEY

Patented Nov. 29, 1938 2,138,581

UNITED STATES PATENT OFFICE

2,138,581

PRIMER FOR HIGH EXPLOSIVES

William E. Kirst, Woodbury, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del., a corporation of Delaware

Application October 25, 1935, Serial No. 46,791

6 Claims. (Cl. 102—6)

This invention relates to a primer for high explosive charges and more particularly to a new and improved water-tight primer container possessing points of novelty and superiority over the prior art.

The high explosives in most common use in blasting operations heretofore have been the commercial dynamites, both of the non-gelatinous and the gelatinous types. These explosives have been brought to detonation by means of blasting caps or the well-known Cordeau. The latter type of initiator has been particularly favored in quarry blasting where vertical well-drill holes have been employed since, in such cases, the Cordeau has been extended to the bottom of the borehole so that it insured the effective detonation of the explosive charge throughout its entire length.

The recent introduction into practical use of explosives incapable of detonation by means of a blasting cap or a line of Cordeau, but requiring the employment of a booster charge of a high velocity explosive more sensitive than the main charge, has made the previous methods of priming ineffective in so far as initiation throughout the charge by means of Cordeau was concerned. Moreover, introduction of two types of explosives in the same blast has appeared undesirable. This is particularly the case since the relatively insensitive explosives disclosed by Kirst and Woodbury (U. S. Patents 1,996,216 and 1,996,217) are completely enclosed in metal containers. Under such circumstances, the use of a nitroglycerin explosive in the customary paper wrapper as primer would mean the loss of the advantage gained by the elimination from the blasting operation of the more sensitive explosive and of ones which had the objectionable feature of causing headaches to those handling them.

An object of my invention is a primer capable of initiating high explosives not sensitive to the action of a commercial blasting cap. A further object is a primer free from the headache-producing properties of the usual nitroglycerin dynamite and having a lower degree of sensitiveness to shock than such dynamites. A still further object is such a primer in which a water-soluble explosive may be used completely protected from the effect of water. Additional objects will be disclosed as the invention is further described.

I have found that the foregoing objects may be accomplished by the use of a primer comprising a rigid, water-tight receptacle containing at least one solid detonating explosive composition capable of initiation by means of a commercial blasting cap or Cordeau. Preferably a metal container such as a so-called "tin" container is employed, said container being provided with a means adapted to hold an initiator adjacent to said detonating explosive and in initiating relation therewith. This initiator holder may comprise various means, as for example, a cup-shaped receptacle or a suitable clamping mechanism attached to the container. Preferably, however, the container is provided with a cylindrical recess or well which extends within the container a short distance. For reasons which will hereinafter be explained, it is also desirable for the lip of said recess or well to extend outwardly a short distance beyond the surface of the container. This cylindrical recess, which may be termed the "initiator well", is of such size as to allow the insertion of a blasting cap or a length of Cordeau. When the cap or Cordeau is fully inserted into the initiator well, the initiator is in initiating but water-tight relation with the explosive in the container. The initiator may be secured to the primer by crimping the projecting lip of the initiator well about the cap or Cordeau, as the case may be.

My improved primer is particularly adapted for use with explosives that are insensitive to, or are detonated with difficulty by, the action of Cordeau or a commercial blasting cap. An example of such an explosive is one comprising 92% ammonium nitrate, 4% dinitrotoluene, and 4% paraffin at a density not less than 1.0. Preferably I use trinitrotoluene as the explosive charge within my primer at a density of about 1.0, though many other materials are available and suitable; for example, tetryl, picric acid, pentaerythritol tetranitrate, various dynamite or gelatine dynamite compositions, and many others. Such explosives are sensitive to the action of a blasting cap or Cordeau and at the same time, when used in the amount contemplated by my invention, are capable of detonating the main explosive charge.

Instead of employing trinitrotoluene or other of the foregoing cap-sensitive materials alone as a primer charge, I may with advantage load the container with a charge of a relatively insensitive explosive that is not capable of detonation by a blasting cap, for example, the ammonium nitrate composition cited previously. The booster charge of trinitrotoluene of the proper density is then inserted within a formed cavity in the main charge. At the time of blast-

ing, the initiator detonates the booster charge which in turn brings about the detonation of the insensitive explosive charge.

The primer described hereinbefore is intended particularly for use with the blasting assembly described in the copending application, Serial No. 46,647 filed October 25, 1935. In such use it is desirable to lower the primer, just before the time of blasting, into its position above the top metal container of the main charge. For such purpose I provide my primer container with an attachment or device, preferably a metal piece soldered onto the top of the container or onto the projecting lip of the initiator well.

Various forms of such attachment may be employed. A preferred form, for example, comprises a wing-shaped sheet metal device soldered onto the top of the container and extending on either side of the initiator well. Such a device may have its metal side arms supported only by the rigidity of the metal of which it is constructed, or the side arms may bend up over, to form a continuous piece of metal. Similarly, the attachment piece may point downward from the projecting lip of the initiator well and be soldered thereto. Another device may comprise a T-shaped metal piece soldered onto the top near the initiator well. Similarly, the attachment device may take the form of a handle for the container, fastened at opposite sides of the upper surface by any desired means.

The foregoing lowering devices serve a very important purpose in the primer described. In the first place they allow the lowering of the primer into the borehole without any strain on the cap itself or on a particular section of the lead tube of the Cordeau, since the cap wires or the countering on the Cordeau are wrapped about, or fastened to, the attachment in such a way as to take up the tension. Similarly, they allow a proper centering of the primer on the containers of the main charge in the borehole. A third advantage is the fact that the presence of such a lowering device aids in assuring proper initiation of the primer by the initiator, since there is no pull on the cap to disturb its location adjacent to the primer charge. An additional advantage is that the danger of breaking off of the Cordeau is lessened. It will be understood that the securing of the initiator by the presence of the lowering attachment is in addition to that obtained by crimping the lip of the initiator well to the cap, though such crimping may be unnecessary and dispensed with, if desired, in which case it may be unnecessary for the lip of the well to extend above the top of the primer container.

In the foregoing, the presence of an initiator well for the insertion of the Cordeau or cap has been mentioned. Preferably, however, two such wells are provided, similar in dimensions, so that detonation of the charge may be assured by the use of more than one initiator. When Cordeau is used, it may be desirable to surround said Cordeau with rubber tubing or other protecting means at the entrance to the initiator well.

The invention is illustrated more specifically in the accompanying drawings, in which Figures 1 to 6 are elevations partly in section of the explosive primer according to my invention, while Figures 1—A to 6—A are plan views thereof. Figure 7 is an enlarged elevation partly in section of the details of my preferred primer. Figure 1 represents a primer container 1 filled with trinitrotoluene 2, for example, as a detonating explosive. Two cylinder recesses or wells 3 and 3' extend a suitable distance within the container while the lips of the wells extend a short distance above the upper surface thereof. The wells are closed at the inner end and are adapted to hold an initiator such as an electric blasting cap or a length of Cordeau and to be crimped about said cap above the upper surface of the container. In Figures 1 to 6 representing various forms of the primer in vertical elevation only one recess or well is seen, since 3' is directly back of 3 and hidden from view by it. The position of the two wells is indicated, howvere, in Figures 1—A, 2—A, 3—A, 4—A, 5—A and 6—A. The lowering device for securing the cap wires or Cordeau countering is indicated by 4. This comprises a bent, sheet metal attachment soldered onto the container and makes possible the lowering of the primer into the borehole without any strain being brought on the electric blasting cap or the Cordeau.

Figures 2–6 illustrate various embodiments of the primer container employing different forms of lowering devices for securing the cap wires. Figure 2 is similar to Figure 1 except that the ends of the sheet metal arms of 4 are bent up and around, and joined to form one metal piece. In this case, the recess well 3 is accessible through an opening in the arm 4. In Figure 3, the lowering device comprises a stiff metal piece 4, soldered to the projecting lip of the initiator well and pointing downward. Figure 4 shows a T-shaped metal piece 4, also soldered to the top of the container and directly in back of the well for the initiator. In this case, the well 3 does not extend above the top surface of the container 2. In Figure 5, the device for permitting the securing of the wires for lowering purposes consists of a handle 4', the two ends of said handle being soldered, or otherwise attached, to the opposite sides of the container. Figure 6 shows an arrangement in which the projecting lip of the initiator well serves as a securing means by the presence of holes 4 in the lip of the well through which the cap wires or the countering on the Cordeau may be passed and thereby fastened. Many other means of forming such a lowering device will be apparent to those skilled in the art.

Figure 7 represents a slightly different form of primer, in which the main explosive charge 5 comprises an explosive insensitive to the action of a commercial blasting cap. An inserted booster charge, represented by 2, comprises an explosive capable of detonation by means of a blasing cap of cordeau, for example trinitrotoluene at a density of 1.0. Both the main charge and the booster charge are enclosed in the same water-tight metal container 1, the booster charge being preferably wrapped in paper 6 and separated from the main charge thereby. A suitable booster charge, for example, may consist of 300 to 500 gms. of trinitrotoluene. The main charge 5 within the container may desirably amount to around 20 lbs. and have the composition 92% ammonium nitrate, 4% dinitrotoluene, and 4% paraffin at a density not less than 1.0. The other features of the primer shown in Figure 7 may be similar to any of those shown in Figures 1 to 6, namely the initiator well and the various lowering devices. Both types of primer are initiated similarly and both function in the same manner in bringing about the detonation of the explosive charge in the borehole, preferably a charge contained in a plurality of metal containers.

The primer disclosed in the foregoing possesses many advantages that make its application very advantageous in quarry blasting operations under the conditions described. It will be understood, however, that many variations may be made from the details and compositions set forth without departing from the spirit of the invention. I wish to be limited, therefore, only by the following patent claims.

I claim:

1. A primer for a high explosive charge comprising a rigid watertight receptacle, a solid detonating explosive within said receptacle, said explosive comprising a main charge incapable of detonation by means of a commercial blasting cap, and a booster charge sensitive to the action of a blasting cap and capable of initiating said main charge, a substantially cylindrical recess extending within said receptacle but in watertight relationship therewith, the lip of said recess extending outwardly beyond the surface of said receptacle, permitting the ready insertion of the initiator at the place of use and allowing the same to be firmly secured in said recess, the separating medium between initiator and said booster charge being sufficiently thin to allow the detonation therethrough of the latter by means of a commercial blasting cap.

2. A primer for a high explosive charge comprising a rigid, watertight receptacle, a solid detonating explosive charge within said receptacle, comprising a main charge of explosive incapable of detonation by means of a commercial blasting cap, and a booster charge of an explosive sensitive to the action of a blasting cap and capable of bringing to detonation the main charge, means forming an initiator well for the reception of the initiator extending into said explosive in propagating relationship with said booster charge but in watertight relationship therewith, the separating medium between the initiator and said explosive charge being such that detonation of the latter therethrough is consistently possible by means of a commercial blasting cap and a lowering device at the top of said receptacle adapted to permit the suspension and lowering of said primer.

3. The primer of claim 1, in which said booster charge comprises trinitrotoluene.

4. The primer of claim 2, in which the lowering device comprises at least one metal arm joined to the top of the container.

5. The primer of claim 2, in which the lowering device comprises a rigid, metal piece secured to an extended portion of the means forming said initiator well adapted to receive the initiator.

6. The primer of claim 2, in which the lowering device comprises an extended lip of the initiator well, said lip having perforations in its side walls, whereby said container may be suspended.

WILLIAM E. KIRST.