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BLASTING EXPLOSIVE ASSEMBLY

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Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5.

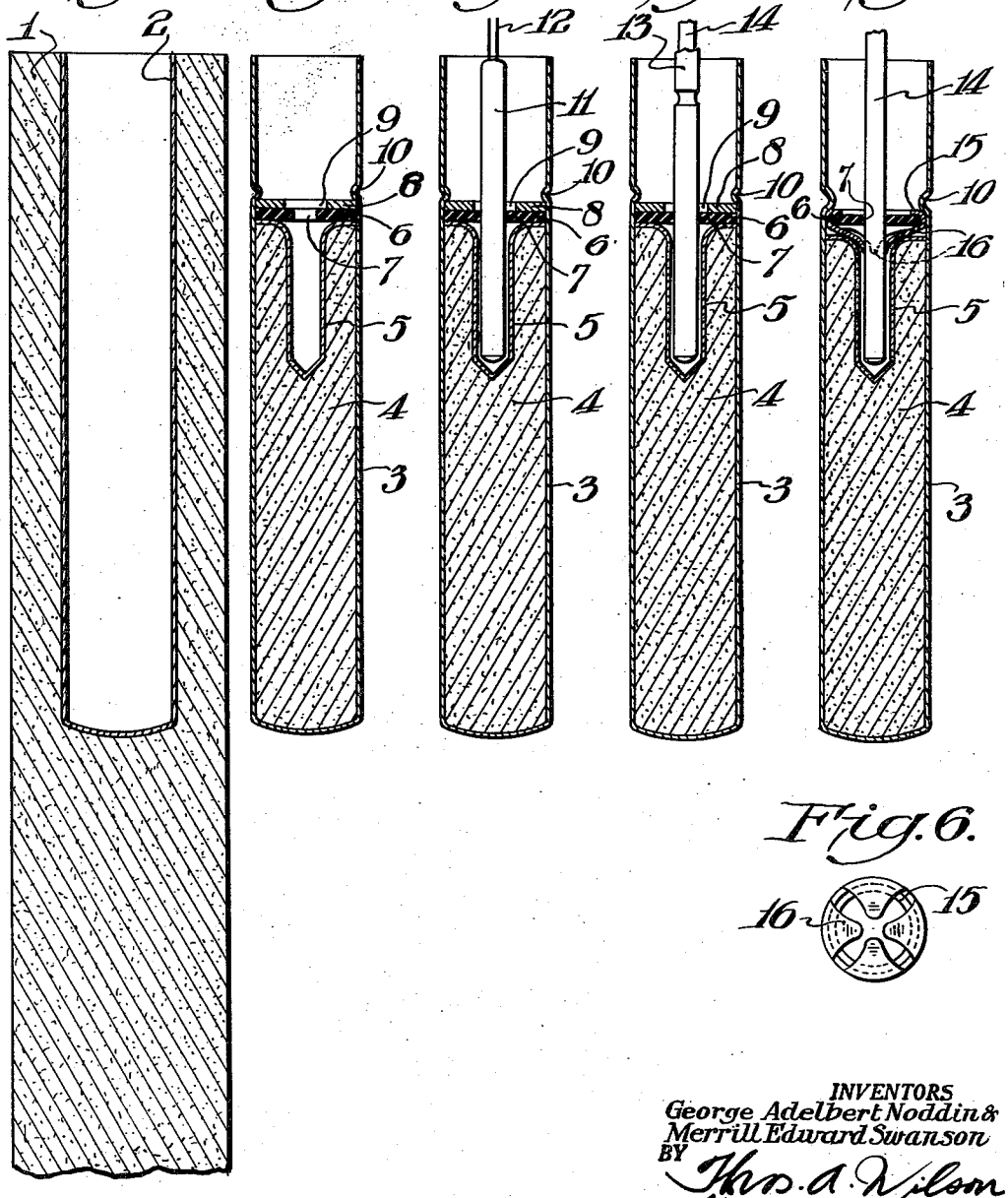



Fig. 6.




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# BLASTING EXPLOSIVE ASSEMBLY

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This invention relates to an explosive assembly of a novel type and one that is designed and arranged to give results of greater blasting efficiency.

In recent years the trend in blasting operations has increasingly been to the use of main charges of explosives of a lower order of sensitivity. In accordance with this tendency, ammonium nitrate has been employed more and more in high explosive compositions as a replacement for nitroglycerin. Furthermore, compositions comprising ammonium nitrate as the principal ingredient and entirely free from nitroglycerine have been introduced satisfactorily into blasting operations. While this reduced sensitivity of ammonium nitrate and other compositions free from liquid explosive nitric esters is advantageous from the viewpoint of safety in manufacture and handling, it is essential that means be employed that will cause complete detonation of the blasting agents. In certain cases, a commercial blasting cap or "Primacord" or other detonating fuse is not sufficient to assure satisfactory detonation.

An object of the present invention is an explosive assembly comprising an explosive charge and means that assure the satisfactory and complete detonation of the same. A further object is such an assembly including an explosive charge of a relatively low order of sensitivity, together with detonating and retaining elements. Additional objects will be disclosed as the invention is described at greater length hereinafter.

We have found that the foregoing objects are accomplished when the assembly of the present invention is employed, which comprises the use of a main explosive charge, usually one of a relatively low order of sensitivity, this charge having an elongated well at the top extending into said charge, this well being lined with a rigid material. A high density charge of a suitable cap-sensitive secondary explosive within a rigid container is introduced into the well, this explosive charge being present in an amount substantially greater than that used in commercial blasting caps. An elongated cavity is present in the charge of secondary explosive and a liner of metal or other rigid material fits into the cavity. A washer of a resilient material such as rubber is above said liner, holding it in place, and desirably a metal washer above the one of resilient material. The washer or washers are of substantially the diameter of the container for the secondary explosive charge and an internal crimp in the wall of the container for said charge holds the washers and metal liner in position. The washers have central perforations through which a detonating device is inserted, either a blasting cap or a length of "Primacord" or other detonating fuse. The perforation in the washer of resilient material is of smaller diameter than that of the blasting cap to be inserted so that, while the cap may be readily inserted through the opening, its withdrawal therefrom is extremely difficult.

The attached drawings will serve to illustrate more clearly the details and novel features of the assembly. Figure 1 is a view of a charge of blasting explosive,



showing the position of the elongated well. Figure 2 is an elevation of the container for the charge of high density, secondary explosive, with cap well liner in place. Figure 3 is a representation of the cap well, with electric blasting cap inserted, while Figures 4 and 5 show inserted, detonating fuse in the same well. Figure 6 is a bottom view of a combination gripping device applicable to the assembly of Figure 5 or Figure 3.

In Figure 1, a main charge of blasting explosive is shown as 1, which may, for example, be a non-nitroglycerine-ammonium nitrate composition of a low order of sensitiveness to impact and to detonating impulses. At the top of the charge is the elongated, lined well, 2.

In Figure 2, the container 3 is shown, of brass or gilding metal, for example. Included therein at the base portion is a pressed charge 4, of a secondary explosive such as pentaerythritol tetranitrate, in an amount for example of 12 grams, charged at a pressure of 50–500 pounds dead weight. A liner 5 forming a cap well has been pressed into this charge to facilitate initiation thereof by the cap or "Primacord," this well being pointed at the bottom, rounded at the top to facilitate insertion of the cap or "Primacord," liner 5 being of gilding metal or other suitable rigid material. Above the cap well liner 5 is a rubber washer, 6, of a diameter to fit the container and having a central perforation 7. Superposed on the rubber washer is a metal washer 8, likewise with a central perforation 9. An internal crimp, 10, in the metal container wall assures the holding in place of the various elements.

In Figure 3 is shown the same assembly, with a loaded electric blasting cap 11, having leading wires 12, inserted into the cap well. In this assembly, as in Figure 2, the opening in metal washer 8 is slightly greater than the diameter of the cap shell, so that the latter is readily passed through. The opening in the rubber washer, 6, however, is substantially less than said diameter. While the cap shell can easily be inserted practically to the bottom of the cap well, its removal therefrom is exceedingly difficult.

In Figure 4, a similar assembly is shown except that, instead of a blasting cap, a length of "Primacord" 14 is inserted into the cap well. Actually, in this figure, a cylindrical metal shell 13 has been introduced into the cap well, into which metal shell the end of the "Primacord" had previously been inserted and crimped in place. If desired, the metal shell may contain an explosive charge at its base, which will be detonated by the "Primacord."

In Figure 5, the end of a length of "Primacord" has likewise been introduced into the cap well, extending to the bottom thereof. The "Primacord" in this case is not enclosed in a metal shell, and means are provided for gripping the "Primacord," e. g. by the combination device 15, whose prongs 16 are in contact with the "Primacord" and prevent its removal from the well but which are too long to dig into a cap shell which is retained by the washer 6. Figure 6 shows a bottom view of the gripping device of Figure 5, with prongs 16 and washer 6.

From the foregoing, it will be seen that the assembly of the present invention is particularly applicable in assuring the complete detonation of high velocity explosives of a relatively low order of sensitivity, and particularly of compositions that require a stronger detonator than a commercial blasting cap. Sensitized compositions high in ammonium nitrate content and containing as sensitizer such oxidizable materials as paraffin, nitrotoluenes and the like are particularly suitable, and such mixtures may be enclosed in completely water-tight metal containers, heavy paper or paper board wrappings, or other protecting material. As stated, the main explosive charge has at the top an elongated well, adapted to receive a

tubular container charged with a cap-sensitive, high explosive charge.

This latter container may be loaded with a pressed, high density charge of a cap-sensitive secondary explosive, for example cyclotrimethylene trinitramine, often designated cyclonite, pentaerythritol tetranitrate, pentolite, ethylene dinitramine (Haleite), and others. This secondary explosive will be present in an amount greater than that present in a commercial blasting cap, an amount greater than 3 grams for example. Into the top of this is pressed a cap well liner, with its walls surrounded by the secondary explosive. Both the container for the secondary explosive charge and the cap well may desirably be made of brass or gilding metal, but I do not intend to be limited as to the rigid material used.

A particular feature of the invention comprises the means for retaining the blasting cap or "Primacord" in position. Seated against the top of said cap well and of substantially the diameter to allow its fitting into the container is a washer of rubber or other resilient material. Above this washer is a second washer of metal, each of said washers being characterized by the usual central perforation. An internal crimp is formed in the wall of the container in such position that it holds the washers and the cap well firmly in place. The central perforation of the metal washer will be such as to allow ready insertion of the cap or other initiator; the perforation of the rubber washer, on the other hand will be substantially less in diameter than the outside diameter of the initiator to be inserted. The top of the cap well will be rounded to permit room for stretching of the rubber washer. With such an arrangement, ready insertion of the cap is possible but its withdrawal will be extremely difficult, as a result of the rubber being wedged between the cap shell and metal washer.

In many cases, it will be found desirable to initiate the charge of secondary explosive by means of detonating fuse, preferably "Primacord." The "Primacord," in such case, may be first inserted to the bottom of a cylindrical metal shell, comparable to a blasting cap shell, and crimped into place therein, said shell then being introduced into the well in the same manner as the blasting cap. Alternatively, the "Primacord" may be introduced directly into the cap well and a gripping device be used such as was illustrated in Figure 6, to prevent undesired removal of the fuse from the well.

Using an assembly of the nature described, it is apparent that the explosion will be initiated as stated, propagated through the wall of the cap well to the secondary explosive charge, and that the main explosive charge will thereby be brought to complete, high velocity detonation.



While the invention has been described at length in the foregoing, it will be understood that many variations in details of assembly, types of materials and compositions, etc. may be used, without departure from the scope of the invention.

We intend to be limited by the following claims:

1. An explosive assembly comprising a main blasting charge, an elongated well extending into said charge, a tubular container fitting into said elongated well, a high density charge of a cap-sensitive secondary explosive present in an amount greater than 3 grams within said tubular container, a liner of rigid material pointed at the bottom and rounded at the top pressed into said dense charge to form a cap well therein, a cylindrical initiator positioned within said cap well, a retainer for said initiator comprising a washer of resilient material, a superposed metal washer and an internal crimp in the said tubular container wall above said washers holding them in position, said resilient washer having a diameter substantially the same as that of the said container and a central perforation smaller in diameter than the said cylindrical initiator, said initiator being inserted through said perforation.

2. The explosive assembly of claim 1, wherein a gripping device is present, having prongs extending below the washers adapted to grasp the initiator extending into said cap well.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 829,595 | McEachern | Aug. 28, 1906 |
| 1,091,878 | Cordray | Mar. 31, 1914 |
| 1,406,844 | Gelm | Feb. 14, 1922 |
| 1,469,442 | Messer | Oct. 2, 1923 |
| 2,138,581 | Kirst | Nov. 29, 1938 |
| 2,476,370 | Hanley | July 19, 1949 |
| 2,535,518 | Rich | Dec. 26, 1950 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 624,134 | Great Britain | May 27, 1949 |
| 108,708 | Germany | Feb. 19, 1900 |