

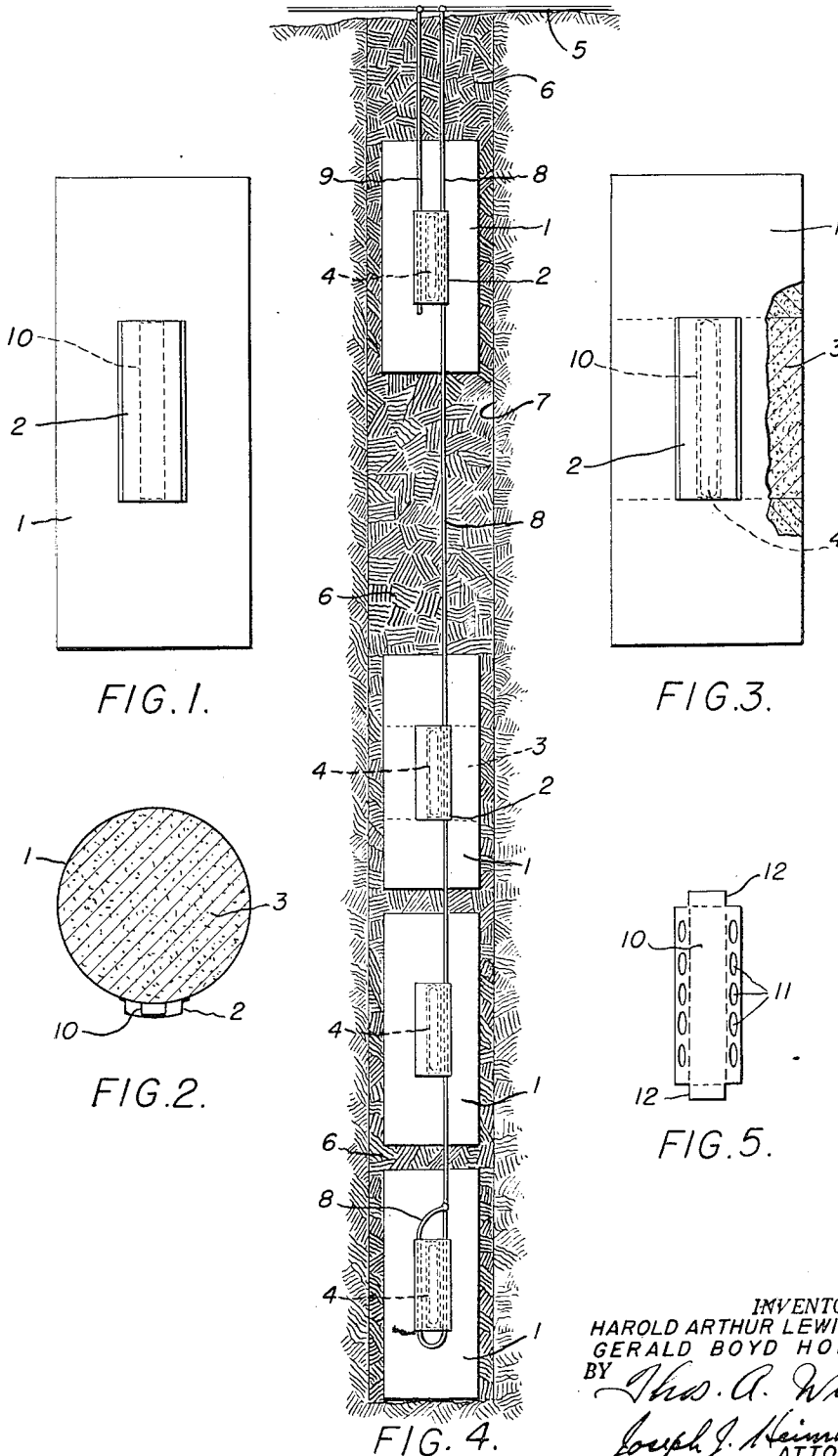
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DETONATING ASSEMBLY

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DETONATING ASSEMBLY

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This invention relates to a method of detonating relatively insensitive high explosives more effectively and to an assembly which is particularly advantageous in a detonation of such explosives.

This is a continuation-in-part of our co-pending application, Serial No. 723,256, filed January 21, 1947, now abandoned.

In quarrying operations and the like, it is customary to locate a row of deep vertical bore holes back of the rock face and substantially parallel thereto, with one or more additional rows behind the front one. Since the bore holes may be from 4 to 9 inches in diameter and exceeding 100 feet in depth, large diameter cartridges are used and are lowered into position by suitable handling procedure. Due to the variations in the nature of the burden at varying depth in the bore hole, so-called deck-loading procedures are frequently followed. This procedure comprises allowing gaps between explosive charges to localize the power at the points where the burden is greater. In other cases the explosive may be loaded in a continuous unbroken column of superposed cartridges or units.

Whatever the method of loading, it is usually advantageous to employ a detonating fuse for firing the explosive charge. A typical detonating fuse is "Primacord," which comprises a cord of high velocity explosive contained within a reinforcing cover, the outside diameter varying between 0.18 and 0.25 inch. In loading the bore hole, it is customary to attach one end of the detonating fuse to the first cartridge and to lower this cartridge to the bottom. Subsequent units are then lowered into the hole, the detonating fuse being adjacent to and at the side of the various cartridge units in detonating relationship therewith.

Detonating fuse finds a particularly important application in connection with relatively insensitive blasting agents such as "Nitramon," a material which cannot be detonated by the action of a commercial blasting cap. "Nitramon" is packaged in metal containers impervious to water, and the main blasting charge is not detonable by means of the usual strand of "Primacord" or similar detonating fuse. A primer charge is therefore included as a portion of the load in the "Nitramon" primer can. This primer charge is detonable by the usual strand of "Primacord," and the main charge is then brought to detonation by means of the primer charge.

An object of the present invention is to provide an effective simplified method of bringing about

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the detonation of high explosives of the above type. A further object is to provide an improved assembly for blasting long columns of relatively insensitive detonating explosives. A still further object is a method and assembly for the certain and efficient detonation of long columns of relatively insensitive explosives with the use of a detonating fuse. Additional objects will be disclosed as the invention is described more fully hereinafter.

We have found that the foregoing objects are accomplished when we provide an enclosing device on the outer surface of the container for the high explosive charge, said enclosing device being adapted to hold at least two columns of detonable explosive adjacent to the container and in detonating relationship therewith. At least one of the columns of explosive is a length of detonating fuse extending beyond one or both of the ends of the container. The remaining column or columns of explosive may be detonating fuse or sealed metal containers charged with an explosive composition readily detonated by detonating fuse. A typical explosive composition of the latter type comprises compressed pentaerythritol tetranitrate.

By the use of an assembly as described above, the need of a separate priming charge is eliminated. However, for more certain priming, it is generally preferred to use at least one cartridge containing a priming charge. The enclosing device preferably maintains the columns of detonating explosive substantially parallel to the longitudinal axis of the container of the high explosive charge, and, on a cartridge containing a priming charge, in that portion adjacent to the priming charge. The enclosing device also holds the columns of explosive in detonating relationship with each other.

The invention will be understood more clearly by reference to the accompanying drawing, which is included for purpose of illustration.

Figure 1 is a side view of a high explosive container with the enclosing device attached thereto.

Figure 2 is a top view of the assembly shown in Figure 1.

Figure 3 is a view of a similar assembly to that shown in Figure 1, with preferred initiating arrangements in place.

Figure 4 is a view of several assemblies deck-loaded within a bore hole.

Figure 5 is a view of a preferred type of a blank to be used to form a partition within the enclosing device.

With particular reference to the figures, 1 des-

ignates a container loaded with a high explosive charge, said container preferably being of a ferrous alloy, for example, 5 inches in diameter by 24 inches in length. 2 represents a rigid enclosing device, preferably of metal, adapted to hold three columns of explosives parallel to the longitudinal axis of the container. 3 designates the position of the charge in a priming can occupied by a priming charge. In Figure 4, 7 represents the sides of the vertical bore hole into which several explosive cartridges have been lowered in accordance with deck-loading procedure. A single strand 8 of "Primacord" detonating fuse is attached to the first cartridge in loop form, so that two lengths of the said fuse pass through the enclosing device 2 of this cartridge. The inserted end of fuse 8 is joined to the longer portion which passes up through the enclosing device 2 of each succeeding cartridge to the top of the bore hole where it connects with trunk line 5 of detonating fuse. Ground or other filling material 6 is used to space the charges of explosive in the desired relationship with each other. A separate strand 9 of "Primacord" extends from within the enclosing device 2 of the upper cartridge to the trunk line 5. Filling material 6 seals the remaining portion of the bore hole. For simplicity only three cartridges are shown in the illustration, it being understood that the number of charges used will vary with the depth and burden in each case. The enclosing device 2 is divided into three tunnels by means of an inserted element 10, a blank for which is shown in Figure 5. The dotted lines on the blank indicate the location where the right angle bend is to be made. The perforations 11 insure that the detonation first will readily pass from one column of explosive to another column then in the enclosing device. The ears 12 are provided so that the center column of explosive may be closed in thereby eliminating any possibility of that unit being dislocated during lowering.

The blasting assembly and procedure of the present invention are applicable whenever large diameter charges in columns are to be fired by means of detonating fuses. In deep holes particularly, the use of detonating fuse such as "Primacord" is very desirable because of the convenience and safety in blasting. In assembling the various elements of the invention, the short columns of detonating explosives, e. g. 6-inch lengths of "Primacord" with the ends thereof water-proofed, or sealed metal containers with detonable explosive charge, are inserted in the central space of the enclosing device on the respective container; this may be done at the manufacturing plant or in the field immediately prior to loading. A single strand of "Primacord" is then attached to the first container, this passing up through the designated enclosing device at least once. The subsequent containers are lowered with the "Primacord" strand passing through the enclosing device.

Frequently deck-loading procedure rather than continuous loading is practiced in charging well drill holes because of the fact that the hole passes through soft materials or faults requiring little blasting execution or because the charge required does not rise high enough in the hole to break the top satisfactorily. Under such conditions, the assembly of the present invention is particularly advantageous. In Figure 4 the second cartridge is shown as containing a priming charge. This is the preferred method to insure satisfactory detonation of the charge. Similarly in Figure 4, two strands of detonation fuse are shown as extend-

ing from the trunk line to the top cartridge. It will be obvious that with this arrangement, satisfactory detonation of the entire column will be assured even if one of the fuses should be severed or otherwise fail to transmit the detonation from the trunk line to the top cartridge.

It is with blasting agents of the "Nitramon" type that the present assembly is especially useful, since this agent comprises a composition of relatively low order of sensitiveness such as to require a detonating charge of high blasting efficiency, said detonating charge itself being capable of initiation by means of a commercial blasting cap or detonating fuse.

The containers for the explosive charge will desirably be sealed metal cans as such containers give the desired protection against water penetration and mechanical disruption. The invention may use, however, containers of any efficiently rigid material, as of suitable plastic, treated paper or cardboard, and the like.

The confining devices on the lateral walls of the container will desirably be of metal also, for example steel plate of suitable thickness, but these also may be of any material of sufficient rigidity. The confinement within the rigid metal device makes more effective the priming effect of the explosive. In the drawing, the enclosing devices have been shown at a position approximately the center of said container, that is, equidistant from the two ends. It will be understood, however, that said device may be at either end of the container or at any desired position thereon, the important consideration being that they are adjacent to the desired priming point of the charge, i. e., to the booster where this is present.

The assembly has been described in the foregoing but it will be understood that many variations in details of component elements, assembly arrangement and charge compositions may be introduced without departure from the scope of the invention.

We intend to be limited, therefore, only by the following claims.

We claim:

1. A detonating assembly comprising a rigid elongated container, a high explosive charge within said container, a rigid enclosing device fixedly attached to the outside of the wall of said container, passing through said enclosing device at least one length of detonating fuse substantially parallel to the longitudinal axis of the container and extending beyond said container at at least one end thereof, and at least one additional column of explosive passing through said enclosing device and in detonating relationship with the said fuse, one of said additional columns of explosive being of lesser length than that of the explosive container and all columns being given explosive confinement by the enclosing device.

2. A detonating assembly comprising a plurality of aligned, rigid, elongated containers, a high explosive charge within each of said containers, a rigid enclosing device fixedly attached to the outside of the lateral wall of at least several of said containers, said enclosing devices on the different containers being substantially in alignment with one another, passing through each of said enclosing devices a continuous length of detonating fuse substantially parallel to the longitudinal axes of said containers, at least one additional column of high explosive passing through each of said enclosing devices and in detonating relationship with the continuous length of fuse, one of said additional columns of

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explosive being of lesser length than that of the explosive container adjacent thereto, and all columns being given explosive confinement by the enclosing devices on the several containers.

3. The detonating assembly of claim 2, in which the short additional column of explosive comprises a length of detonating fuse protected against moisture penetration.

4. The detonating assembly of claim 2, in which the short additional column of explosive comprises a compressed high explosive charge enclosed in a sealed, rigid container.

5. A detonating assembly comprising a plurality of approximately cylindrical metal containers in alignment with one another, a relatively insensitive high explosive charge within each of said containers, a more sensitive explosive charge occupying a portion of the space within at least several of the containers, a rigid enclosing device fixedly attached to the outside of the lateral wall of each of the containers holding the more sensitive explosive charge and at a position adjacent to said sensitive portion, passing through each of said enclosing devices a continuous length of detonating fuse substantially parallel to the longitudinal axes of said containers, at least one

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additional column of high explosive passing through each of said enclosing devices and in detonating relationship with the continuous length of fuse, one of said additional columns of explosive being of lesser length than that of the explosive container adjacent thereto, and all columns being given explosive confinement by the enclosing devices on the several containers.

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