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EXPLOSIVE PRIMER PACKAGE WITH SLIP FIT FUSE HOLDER

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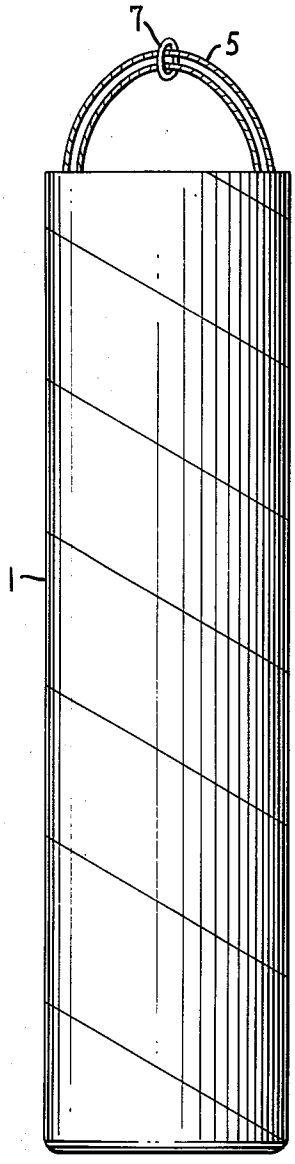


FIG. 1

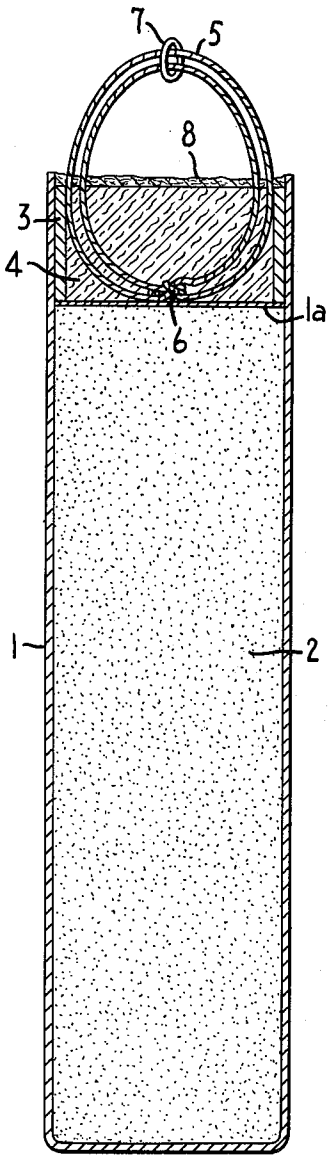


FIG. 2

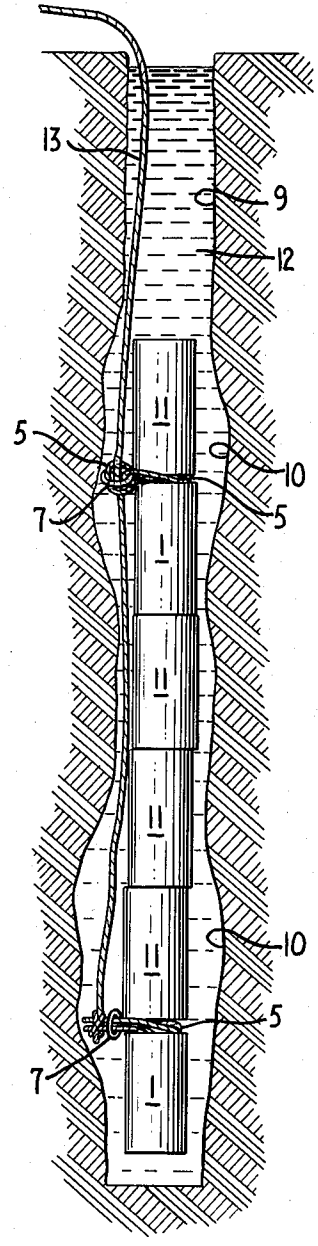


FIG. 3

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EXPLOSIVE PRIMER PACKAGE WITH SLIP FIT FUSE HOLDER

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This invention relates to an explosive primer and particularly to an explosive primer for multiple priming cartridges of insensitive nitrocarbonitrates, loaded in water-filled drill holes.

In certain mining and quarrying operations the geographical locations and rock formations are such that the drill holes fill with water. The chattering of the drill bit and the scouring action of the water often causes the periphery of the hole to collapse. When the walls of the hole collapse, they either block or constrict the hole, or fall to the bottom of the hole, leaving a distended cross section. If holes tend to constrict or block they must be loaded through a loading tube or hollow drill stem which is withdrawn from the hole after the explosive charge is in position. In distended holes where the explosive charge is dropped or lowered into the hole, it is mandatory that priming units be kept in intimate contact with the initiating medium. In common practice the initiating medium is a length of detonating fuse that extends the full depth of the hole. This is tied to the fuse of each primer in the train, which lends a certain inflexibility to the loading of the drain in a drill or bore hole.

For reasons of economy, holes are generally loaded with a combination of cartridged nitrocarbonitrates and cartridged high explosive primers. The ratio of high explosive primers to cartridges of nitrocarbonitrates can vary from 10% to 50%. High explosive primers normally consist of cartridges of gelatin dynamites of the 60% to 75% strength grades. Under certain conditions other sensitive nitroglycerine dynamites such as semigelatins, ammonia gelatins and ammonia dynamites may be used as primers. Such primers are relatively sensitive to shock and friction, and will detonate from the impact of a .30 caliber rifle bullet. These gelatin dynamite primers are dropped or lowered into the drill hole. Since there is no predetermined means of maintaining contact with the detonating fuse in enlarged sections of the hole, reliance must be placed on the extreme sensitivity of the gelatin dynamite primer to accept detonation from the initiating source. Cast or cartridged primers with a central or peripheral priming tunnel and having more acceptable sensitivity than gelatin dynamites have been tried without success. Such primers were often of low density, unwieldy size and irregular shape, causing them to sink slowly in water or bind in the hole, interfering with the loading operation. Such primers were either extremely expensive, or did not possess the detonating velocity and brisance to produce efficient results.

In accordance with this invention, a high density explosive primer is provided that is relatively insensitive to shock and friction, has high detonating velocity and brisance, will not float in water, and is equipped with a holder means for maintaining intimate contact with the initiating medium, such as a detonating fuse extending the length of the train and termed herein the downline fuse, to distinguish it from the shorter fuse or fuses leading therefrom to each primer. This is accomplished by combining with the primer container a holder such as a ring adapted to retain the detonating fuse to the primer in close proximity to the initiating medium such as a down-line detonating fuse leading to other cartridges in the train, such as other primers. If desired, the downline detonating fuse can be attached to the holder of the first primer in the train, and then merely slipped through the holders of succeeding primers. The slit fit provides utmost flexibility in dropping the successive primers into contact with the preceding cartridges, such as nitrocarbonitrate cartridges in a distended drill hole.

The holder means can best be attached to the primer fuse by threading it on or otherwise attaching it to a single or a double detonating fuse bail thereof, but other means of attachment obviously can be used, as will be apparent to those skilled in this art. An ordinary bail can be used, for example, and the holder attached to the bail, with the fuse to the primer running through the holder. The holder can also be attached independently of the bail, anywhere on the primer package, provided it is in a position to grasp or retain the fuse running to the primer and the longer downline fuse running to the other primers of the train and ensure that the one is in close proximity to the other. In this way, detonation of each primer in series along the train is assured, and interruption of the shock wave along the train in a distended hole is prevented.

The holder means can take the form of a ring, as exemplified in the drawings, but the physical shape or configuration is in no way critical, and apertured plates and discs, clasps, clips, hooks, clamps, grips, lugs, helices, slides and similar means can be used, dimensioned so as to hold the initiating medium or downline detonating fuse in close proximity to the fuse to the primer. The term "ring-shaped" as used in the claims encompasses all of the above types of holder means, whether circular, or elipitical, or otherwise ring-shaped in cross-section.

The holder is preferably of brass, but it can be of any other metal, preferably nonflammable, such as steel or iron, or of plastic material nonfusible at the temperature of the burning fuse, such as polytetrafluoroethylene, urea-formaldehyde, phenol-formaldehyde, polycarbonate or polyester resins.

The drawings illustrate a preferred embodiment of the invention.

FIGURE 1 is a view in elevation of an explosive primer cartridge of the invention;

FIGURE 2 is a longitudinal cross section of the explosive primer cartridge of FIGURE 1;

FIGURE 3 is a longitudinal section of a distended drill or bore hole, showing the manner in which the explosive primers of FIGURE 1 are used to prime a train of cartridges of nitrocarbonitrates.

The explosive primer of FIGURES 1 and 2 includes a spiral wound cartridge **1** equipped with double detonating fuse bail **5** and a brass contact ring **7** in accordance with the invention. The spiral wound cartridge **1** is filled to a predetermined height **1***a* with a high explosive, have a density of 1.4 and a detonating velocity of 18,000 ft./sec. Any high explosive can be used, such as TNT sensitized ammonium nitrate type slurry high explosives, smokeless powder sensitized ammonium nitrate type slurry high explosives; nitrostarch sensitized ammonium nitrate type slurry high explosives; TNT-ammonium nitrate pellet form solid high explosives and nitrostarch sensitized ammonium nitrate type semisolid high explosives, nitrocarbonitrates, nitroglycerine dynamites, such as semigelatins, ammonia gelatins and ammonia dynamites. The density is not critical, but should exceed that of water by a sufficient amount of ensure that the primer will not float, and will preferably be at least 1.4. The detonating velocity will be sufficiently high to detonate the nitrocarbonitrate cartridges. This is known, and in the case of nitrocarbonitrate cartridges is usually at least 18,000 ft./sec. In any case, it forms no part of this invention.

Seated on top of the charge of high explosive is a booster cup 3 containing a booster explosive. Any booster explosive can be used, preferably in cast form, such as pentolite, Composition B or trinitrotoluene having a density of 1.6 and a detonating velocity of 21,000 ft./sec. The density is not critical, and is sufficiently high to ensure that the primer will no float in water, and will usually exceed 1.4. The detonating velocity is sufficient to initiate the primer, as is known. This booster cup 3 is sealed in the explosive cartridge 1 by a plug of microcrystalline wax 8.

Cast into the booster cup is a double detonating fuse bail 5 which has been knotted 6 in the cast explosive. A ¾" brass ring 7 in accordance with the invention has been threaded on the double detonating fuse bail 5 to serve as a holder ring for the initiating or downline fuse to the other primers 1 in the train of nitrocarbonitrate cartridges. A single fuse bail can also be used.

In FIGURE 3 is shown in longitudinal section a drill or bore hole 9 in which two explosive primers 1 are used to prime a train of cartridges of nitrocarbonitrate 11. As shown, the drill hole 9 has become distended at points 10, and is filled with water 12. In practice, a downline detonating fuse 13 is attached to the first primer 1 by knotting it to the brass contact ring 7 and double detonating fuse bail 5, and the primer is then lowered to the bottom of the hole. Subsequent cartridges of nitrocarbonitrate 11 are dropped or lowered into the hole. Additional explosive primers 1 are loaded into the hole by threading the downline detonating fuse 13 through the brass contact ring 7 on the double detonating fuse bail 5 and allowing the cartridge to drop into the hole 9, into which it is consequently guided by the downline fuse into contact with the preceding nitrocarbonitrate cartridge 11, despite the distentions 10 in the hole. In practice, predetermined loading procedures are adopted, and the required number of explosive primers 1 needed to prime the desired number of cartridges 11 of nitrocarbonitrate can be threaded on the downline detonating fuse 13 prior to loading. A system can be utilized whereby a certain number of nitrocarbonitrate cartridges 11 are dropped in the hole, and then an explosive primer 1 is allowed to slide down the downline detonating fuse 13.

Other alternatives will be apparent to those skilled in this art. For example, long length cartridges of nitrocarbonitrate can be fitted at one end with an explosive primer in accordance with the invention, having a detonating fuse bail and fuse-retaining holder, instead of packaging the primer separately. These can be charged in a train in the bore or drill hole with the holder of each primer of each cartridge retaining the fuse running between the cartridges.

The following is claimed:

1. An explosive primer package comprising, in combination, a container having therein a high explosive and a booster charge; a ring-shaped fuse holder attached to the package and having a smooth-surfaced, relatively short guide passage dimensioned to receive a detonating fuse in a nonbinding slip fit, and a booster detonating fuse running through the holder to the booster charge, and retained by the holder in close proximity to a detonating fuse held therein; the said package being adapted to be threadably attached by the holder to a downline detonating fuse and dropped down a bore hole by sliding down the line, without binding on or breaking the line, with the holder retaining the downline fuse in close proximity to the booster fuse of each such package on the line, to set off all such packages on the fuse when the fuse is fired.

2. An explosive package in accordance with claim 1, in which the high explosive is a nonsensitive high explosive.

3. An explosive primer package in accordance with claim 1, in which the high explosive is a gelatin dynamite.

4. An explosive primer package in accordance with claim 1, in which the high explosive is an ammonia dynamite.

5. An explosive primer package in accordance with claim 1, in which the high explosive is an ammonia gelatin.

6. An explosive primer package in accordance with claim 1, in which the high explosive is a semigelatin dynamite.

7. An explosive primer package in accordance with claim 1, in which the booster charge is pentolite.

8. An explosive primer package in accordance with claim 1, in which the booster charge is composition B.

9. An explosive primer package in accordance with claim 1, in which the booster charge is trinitrotoluene.

10. An explosive primer package in accordance with claim 1, in which the booster detonating fuse is a detonating fuse bail.

11. An explosive primer package in accordance with claim 1, in which the booster detonating fuse is a double detonating fuse bail.

12. An explosive primer package in accordance with claim 1, in which the high explosive and the booster have a density of at least 1.4 and a detonating velocity of at least 18,000 ft. per second.

13. An explosive primer package in accordance with claim 1, in which the holder is in the form of a ring.

14. An explosive primer package in accordance with claim 13, in which the ring is of brass.

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