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3,160,536
BLASTING EXPLOSIVE

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1 Claim. (Cl. 149—8)

The present invention relates to a water sensitive blasting explosive.

Blast holes are commonly prepared by air drilling or wet drilling methods, and in some refractory formations of extreme hardness such as in taconite, for example, the hole is jet pierced by means of a hydrocarbon-oxygen high temperature flame. In some cases such holes have been prepared to depths greater than one hundred feet. The holes are charged with conventional cartridges of explosive which are to be detonated in the hole. Certain difficulties are often encountered when such methods are employed. Seepage water has filled such holes to substantial depths; consequently expensive high grade waterproof packed explosives have been used instead of inexpensive water sensitive compounds such as ammonium nitrate and the like. Also, blast holes may be de-watered but rain may completely ruin this work; likewise, any bags of water sensitive explosives that might be stacked near the holes ready for loading may be severely damaged from the standpoint of their use as a blasting agent.

Another disadvantage of the prior art blasting methods is that the walls of the hole are quite often not perfectly regular and could cause a temporary jamming of the explosive cartridge in the hole thereby preventing their insertion to the bottom and forming an air pocket beneath and around the cartridge. It is well known that such air pockets produce a cushioning effect which decreases the blasting efficiency.

One presently used method of charging such blast holes which partially overcomes the aforementioned problems involves the placement of a prill of an inexpensive water-sensitive explosive in a water-impervious flexible plastic bag which is then lowered into the water-containing blast hole for detonation. However, it has been found that such bags are frequently punctured either from physical handling, contact with sharp-wall surfaces within the hole, or by rock tremors from nearby blasts. As a result, water seeps into the bag and at least partially dissolves the water-sensitive explosive, thereby reducing its effectiveness as an explosive.

The present application is a division of U.S. Patent 3,064,572 issued November 20 ,1962, directed to a method and means for providing a charge of water-sensitive explosive in a blast hole. My present application is directed specifically to a water sensitive blasting explosive for use in the method and means described in my aforementioned patent.

An object of the invention is to provide an explosive charge including a granular water sensitive explosive which can be placed in a water-containing blast hole without loss of brisance value.

In accordance with the present invention, a water-sensitive explosive is charged in a blast hole by placing therein a hydrophobic explosive mixture encased within a water-impervious flexible plastic container, the mixture comprising the water-sensitive explosive, a liquid hydrocarbon, and a hydrophobic jelling material in an amount sufficient to impart a jelly-like consistency to the liquid hydrocarbon. The jelling material acts as a water-proofing agent which coats the explosive, thus rendering the latter unaffected by accidental leakage of water into the container.

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It has been found that the explosive efficiency of ammonium nitrate in the form of prill can substantially be increased by the addition of a liquid hydrocarbon. Its effectiveness is also increased by treatment with other relatively non-compressible materials. Treatment with hydrocarbon liquid such as kerosene or fuel oils will reduce the ammonium nitrate's sensitivity to water to a certain degree but not sufficiently for present purposes.

The water resistance of low cost, water sensitive explosives can be greatly increased by incorporating a hydrophobic jelling agent in the hydrocarbon liquid to be mixed with the granular explosive. Metallic soaps have been found suitable as jelling agents. For example, in one test kerosene was employed as the hydrocarbon liquid and to this was added an aluminum soap of 2-ethyl hexoic acid compound in the proportion of 7½ parts, by weight, of the soap to 100 parts of kerosene. The soap was completely dissolved in the kerosene by stirring and heating to about 125 to 150° F., and after cooling the liquid acquired a jelly-like consistency. Ammonium nitrate prill was then added to form a freely flowable slurry. The proportions were about 1 gallon of the solution to about 80 lbs. of commercial-grade ammonium nitrate. The increased water resistance attainable by the present invention was shown experimentally by stirring ammonium nitrate with the jelly-like hydrocarbon mixture, draining off the excess liquid, and placing the otherwise unprotected aluminum nitrate in a cold water bath. It was readily apparent that the hydrophobicly jelled hydrocarbon coated the ammonium nitrate granules with a protective film, and only after 35 minutes was there any appreciable dissolving action of the water on the ammonium nitrate. This compares favorably with a similar test in which uncoated ammonium nitrate was placed in cold water and found to dissolve immediately, and a third test in which ammonium nitrate was coated with untreated kerosene, placed in cold water, and found to dissolve in less than 2 minutes.

Thus, the hydrophobicly jelled kerosene protective film was found to be stable when immersed in water for relatively long periods, and was broken during the interim only by stirring. When the jelled kerosene ammonium nitrate mixture is charged into the plastic bag in a bore hole, only a very small area of the mixture adjacent a possible puncture of the intermediate tube bag can be subject to the action of water in the bore hole. The dissolving action of the water is so greatly retarded that only a very small portion of the explosive can be inactivated in periods substantially longer than ½ hour.

When aluminum soaps are employed with hydrocarbons of the kerosene type, it is found that about 3% by weight of the soap is sufficient to impart a jelly-like consistency to the liquid with 7% the preferred upper limit, although up to about 10% by weight aluminum soap can be used. Other suitable liquid hydrocarbons suitable for practice of the present invention include gasoline, kerosene, and fuel oil. Also, other well-known jelling agents that are hydrophobic may be used, such as colloidal carbon blacks, colloidal silicas, and mineral waxes. The hydrocarbon-jelling agent mixture should form at least about 10% by weight of the explosive.

It is important that the charge fill the blast portion of the hole as completely as possible, so as to avoid air pockets which tend to cushion the explosion and decrease the explosive efficiency. To this end, it is preferable to employ a weighting material having a high bulk density and which is comminuted fine enough to spread out against the bottom of the blast hole so as to avoid air spaces. Since water in the blast hole contributes to fill any spaces as a non-compressible shock transmitting medium, it will be advantageous to puncture the weight material bag so that water can mix with the comminuted weighting material and fill spaces between the individual particles. Alternatively, it is also contemplated that the comminuted weighting material may consist of water soluble substance such as a metal salt which, when water leaks through suitably sized small punctures, will dissolve slowly to allow the explosive charge above it to sink and fill the bottom of the blast hole more snugly and completely with active explosive. In this way practically no loss in blast hole depth is sustained.

What is claimed is:

An explosive mixture for charging blast holes which comprises a mixture of granular ammonium nitrate, a liquid hydrocarbon and a metallic soap, the metallic soap being present in amount from 3% to 7% by weight of the liquid hydrocarbon, and the hydrocarbon-metallic soap mixture forming at least about 10% by weight of the mixture so as to form a jelly-like consistency which coats the ammonium nitrate.

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