

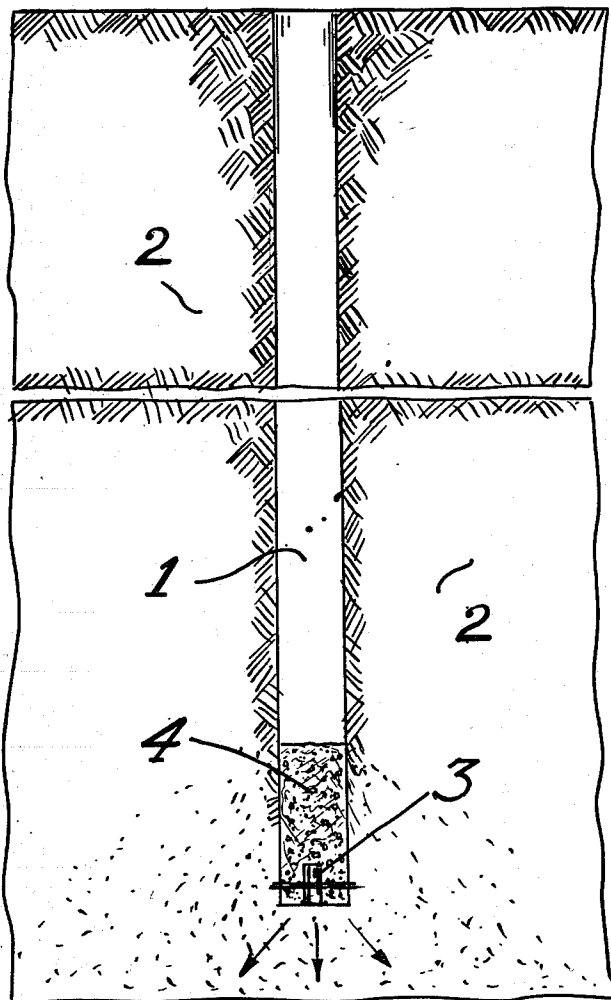
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TAMPING FOR EXPLOSIVES

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TAMPING FOR EXPLOSIVES

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2 Claims. (Cl. 102—11)

This invention relates to improvements in the tamping of explosives.

In reflection shooting, it is customary to detonate a charge of explosive at the bottom of a drill hole 20' deep or deeper. Since the charges used are as a rule small, it is practical to fill the bore hole with water instead of tamping the charge with soil and thus render it possible to explode many charges in the same hole. This so-called water tamping, however, brings about a disadvantageous distribution of the energy released upon the explosion of the charge. Thus most of the energy is released into the water and relatively little energy is directed vertically downward.

It is an object of this invention to direct as much as possible of the energy downward so that (1) copious amounts of energy may be available for reflection at the subterranean boundaries between the geological strata which it is desired to map; (2) so that less energy may be carried in the surface waves, which must be filtered out anyway in order that the reflections may be recorded clearly and with sharp beginnings; and so that yet smaller charges of explosives may be used.

Other objects will be apparent from the specification and from the accompanying drawing in which latter the figure is a longitudinal sectional view through a drill hole containing a charge of dynamite confined in a quick setting cement.

The figure of the drawing discloses in longitudinal section a drill hole loaded in accordance with this invention.

Referring to the drawing, reference numeral 1 designates a drill hole in the earth 2 extending to a convenient depth such as from approximately 20' to 100'. A charge of dynamite 3 is lowered to the bottom of the hole 1. A suitable quantity of a quick setting plastic material is poured into the hole 1 forming a mass 4 confining the charge 3. Explosion of the charge 3 customarily deepens the hole 1 and a second charge of explosive 3 is lowered into the hole and confined with a mass 4 of quick setting plastic material for a repetition of the shooting.

The use of plastic quick setting material for confining the charge 3 of explosive may be compared with the use of water for a similar purpose as follows: When a charge 3 of explosive

lying on the bottom of hole 1 is detonated, the energy is distributed according to the acoustic resistance of the surrounding media. The acoustic resistance is defined in this specification as the product of the density and the velocity of sound through the material. Thus,

$R = DV$, where
R=acoustic resistance;
D=density;
V=velocity of sound through material. 10

If the dynamite lies on the bottom of the hole and is covered with water, the energy which is transmitted downward into the formations below is: 15

$$E_w = \frac{D_w V_w}{D_s V_s} \times E_s$$

where

D_w =density of water, 20
 V_w =velocity of sound in water,
 D_s =density of the soil at the bottom of the hole,
 V_s =velocity of sound in the soil,
 E_w =energy transmitted into the water. 25

Now

$$D_w = \frac{1 \text{ gr.}}{\text{cm}^3}$$

$$V_w = 1460 \frac{\text{m.}}{\text{sec.}} \text{ approximately} \quad 30$$

$$D_s = \frac{2.2 \text{ gr.}}{\text{cm}^3} \text{ approximately} \quad 35$$

$$V_s = 2000 \frac{\text{m.}}{\text{sec.}} \text{ approximately}$$

Then

$$E_w = \frac{1460 E_s}{2.2 \times 2000} = 0.33 E_s \text{ approximately} \quad 40$$

In words, the energy transmitted downward is only one-third as great as the energy which is passed into the water and lost. Hence, of every four pounds of explosive, three pounds are lost into the water and are detrimental in setting up vigorous surface waves, or "ground roll". 45

According to my invention, a material 4 having a high velocity of sound and a high density is used to cover the charge in order to transmit 50

a greater amount of energy downward. Thus, for instance, if the density of the material 4 is

$$\frac{3 \text{ gr.}}{\text{cm}^3}$$

and the velocity of sound in it is

$$\frac{3500 \text{ m.}}{\text{sec.}}$$

we have, for the same soil conditions, assumed in the example above,

$$E_s = \frac{3 \times 3500 E_m}{2.2 \times 2000} = 2.39 E_m$$

where E_m is the energy transmitted into the material with which the dynamite is covered. Thus more than seven times as much energy is directed downward than in the case of water covering the dynamite.

The material used to constitute the mast 4 may be a quick setting cement. The density of set cement is about

$$\frac{3 \text{ gr.}}{\text{cm}^3}$$

and the velocity of sound through it of the order of

$$\frac{3000 \text{ m.}}{\text{sec.}}$$

Alternatively, calcium oxy-chloride or magnesium oxy-chloride can be used as the confining material. Thus oxy-chlorides can be mixed with crushed concrete, crushed brick or crushed rock which will increase the density of the mixture. The oxy-chlorides when mixed with water and also when mixed with crushed concrete, brick or rock will harden in about 15 minutes. Thus it is necessary to wait only fifteen minutes before the charge is exploded after the dynamite charge and oxy-chloride mixture have been dropped to the bottom of the hole. A mixture of 100 pounds Portland cement and 20 pounds of gypsum can be used. Crushed rock can be added to this mixture.

In practice the charge 3 is lowered to the bottom of the hole 1, and a quantity of the quick setting plastic material saturated with water is

poured into the hole upon the charge 3. The material begins to set around the charge 3 within a few minutes. It is not necessary that all of the material be set completely. A thin shell of set material may be sufficient.

While specific examples of tamping materials have been described, it will be understood that other materials, plastic when sufficiently wetted and having the property of setting quickly, can be used. The material should harden under water. The material used must have a high density and a high velocity of sound through it. The material or mixture when set should have a density greater than 2.5 and a velocity of sound through it greater than 2500 meters per second.

In the use of the material for reflection shooting, successive charges 3 of explosive are shot in the same hole 1. The hole 1 deepens after each shot when the material 4 is used for covering the charge 3. The hole 1 is not lost by caving in of the side walls of the hole after the explosion, as happens when the hole is filled with water as the tamping agent. A relatively small quantity of material 4 is used as compared with the large quantity of water necessary to fill the hole, especially when the bottom of the hole is in porous sand.

Various changes may be made within the scope of the appended claims in which it is desired to claim all novelty inherent in the invention as broadly as the prior art permits.

I claim:

1. Apparatus for directing explosive energy in a given direction, which comprises means for confining an explosive charge against a surface to be blasted, the means comprising magnesium oxy-chloride which when set has a density greater than 2.5 and a velocity of sound through it greater than 2500 meters per second.

2. Apparatus for directing an explosive energy in a given direction, which comprises means for confining an explosive charge against a surface to be blasted, the means comprising a body of calcium oxy-chloride when set has a density greater than 2.5 and a velocity of sound through it greater than 2500 meters per second.

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