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APPARATUS AND METHOD FOR SEISMOGRAPHIC
EXPLORATION SHOOTING
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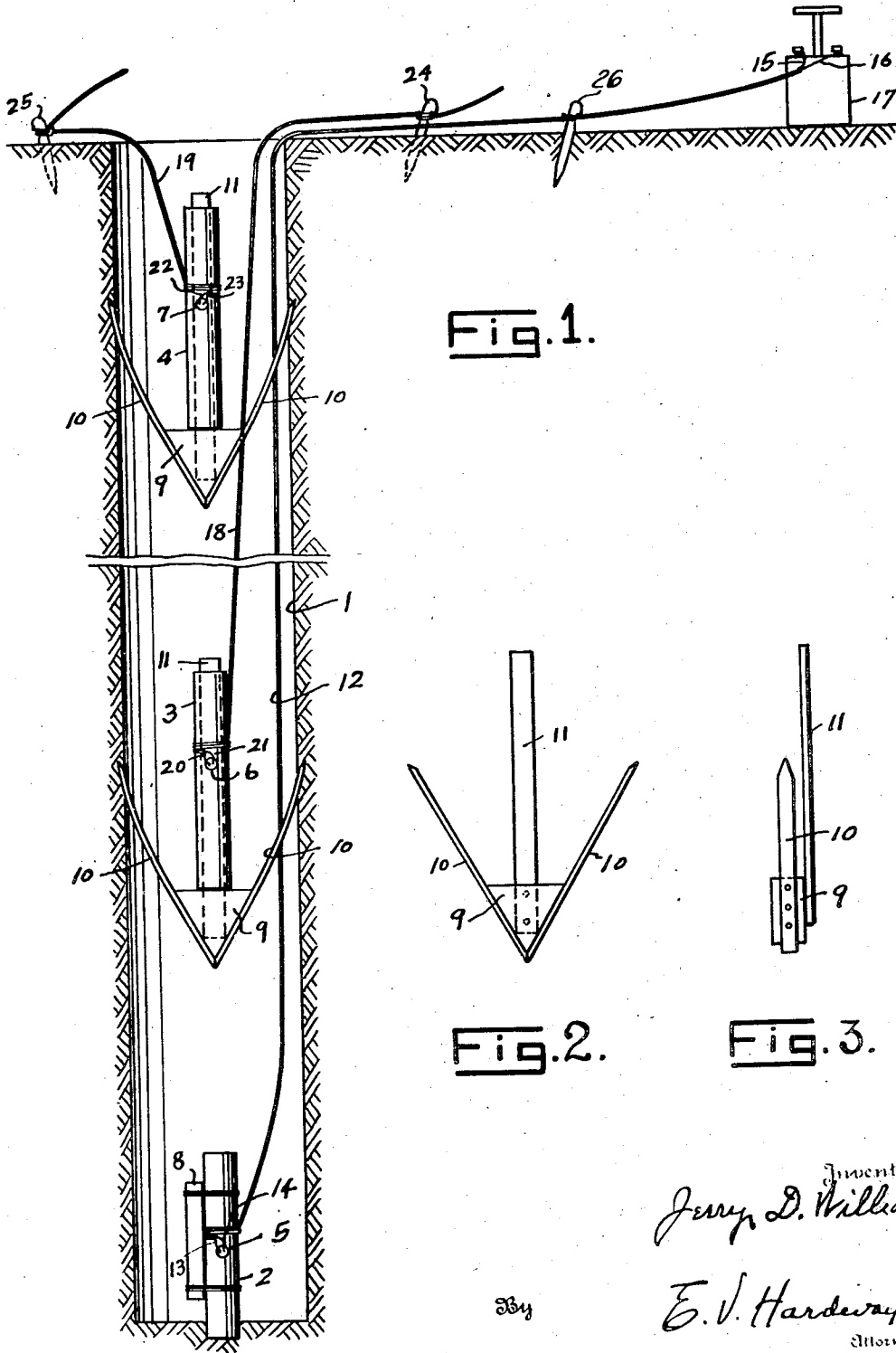


Fig. 1.

Fig. 2.

Fig. 3.

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APPARATUS AND METHOD FOR SEISMO-
GRAPHIC EXPLORATION SHOOTING

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1 Claim. (Cl. 102—21.8)

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This invention relates to an apparatus and method for seismographic exploration shooting.

In seismographic exploration it is common practice to drill bores into the earth and lower explosive charges into the bore and explode the charges and make recordings of the vibrations by means of conventional recording instruments at the surface and from which maps of the subterranean structures may be made. The common practice is to set casing in the bore to maintain the side walls thereof and the explosive charges are usually lowered and exploded, one at a time, working from the bottom of the bore upwardly; that is, a charge is lowered to the bottom or near the bottom of the bore and then fired and then another charge is lowered to a lesser depth and fired and so on upwardly. The bores vary in depth from a few feet to several hundred feet and the casing opposite the point where the explosion occurs is destroyed and the remaining portion of the casing is usually then withdrawn from the bore and salvaged. This requires a great deal of time and expense in casing the bore and in recovering that portion of the casing not destroyed. Furthermore when an explosion occurs the casing above it is sometimes filled or partly filled with earth formation so that the next explosive charge cannot be lowered to the desired point; also the bore is usually filled with mud laden fluid so that the force of the explosion will not be expanded upwardly through the bore but rather will be expanded out against and through the formation. When the explosion occurs a considerable portion of this mud laden fluid is forced out of the bore so that, in many cases, the bore must be refilled with the fluid before the next succeeding charge is fired.

The present invention embodies means and a method whereby all of the charges may be located at the desired points in an uncased bore and separately anchored therein and fired one at a time, in succession, from below upwardly thus dispensing with the casing in the well and correspondingly reducing the time and expense necessary to case up the bore and to thereafter withdraw the casing. The apparatus herein described also assist in diverting the force of the explosion out through the surrounding strata rather than upwardly through the bore and also minimizes the amount of mud laden fluid which is expelled from the bore as a result of the explosion.

It is another object of the invention to provide means for supporting the explosive charges in the bore which will shield a charge from the

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force of an explosion beneath so as to prevent its premature explosion.

When an explosion occurs a cavity is usually formed in the bore causing a caving in of the walls above. The invention also embodies means for securely holding the unexploded charges in their selected position notwithstanding the caving in of the walls of the bore.

With the above and other objects in view the invention has particular relation to certain novel features of construction, operation and arrangement of parts and to a novel method, an example of which is given in this specification and illustrated in the accompanying drawings, wherein:

Figure 1 is a vertical, sectional view of an earth bore showing the shooting apparatus in position therein in readiness to be exploded.

Figure 2 is an elevational view of an anchoring device for a charge; and

Figure 3 is a side view thereof.

Referring now more particularly to the drawing wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates an earth bore which may be of any selected depth. In drilling this bore and during the subsequent shooting operations the bore is maintained filled with a mud laden fluid which will maintain the walls thereof. Any selected number of explosive charges may be located in this bore; three charges numbered 2, 3 and 4, respectively, are shown spaced apart from the bottom of the bore upwardly. However, any desired number of explosive charges may be used. The explosive is contained in a suitable container formed of any suitable composition material or metal. Each explosive charge is provided with a detonator indicated by the numerals 5, 6 and 7. The lower charge 2 is preferably lowered to the bottom of the bore as shown and to facilitate the lowering thereof and maintain said charge in place a suitable weight 8 may be secured thereto as shown in Figure 1. The other explosive charges may be anchored in the bore against substantial upward movement by an anchoring device which will be described more in detail.

This anchoring device is preferably formed of a block of wood 9 which presents, in elevation, a triangular shape with one apex downwardly. It is of approximately the same width as the diameter of the charge supported thereby. Secured to the upwardly diverging sides of the block 9 are the wings 10, 10 which diverge upwardly and whose upper ends are free and may be pointed if desired. These wings are slightly flexible and are also preferably formed of wood. Secured to

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the block 9 approximately midway between the wings 10, 10 and upstanding from the block there is a post 11 also preferably formed of wood. While the various parts of the anchor are preferably formed of wood they may be formed of any other suitable material.

Each explosive charge, excepting the bottom one, is mounted on the corresponding block and against the post 11 which extends up some distance above the wings. The charge may be secured in place in any preferred manner. The spread of the wings 10 is somewhat greater than the transverse diameter of the bore 1.

In equipping the bore for carrying on the shooting operation the explosive charge 2 is first lowered into the bore to the lower end thereof. It is lowered by means of a cable 12. This cable is provided with two electrical conducting wires which are suitably insulated by a surrounding insulating material and they are also insulated from each other. The lower ends 13, 14 of these conductors are connected to the terminals of the detonator 5 in the usual manner and their upper ends 15, 16 are to be connected to the terminals of a firing equipment 17, at the ground surface, commonly known as a blaster. The other charges 3 and 4 are then lowered in succession into the bore to their desired locations. They may be forced downwardly into the bore by means of a suitable rod provided for the purpose and while being lowered the wings 10 will frictionally engage the walls of the bore and will yield sufficiently to allow the charges to be moved downwardly. The cables 18, 19 are suitably secured to these respective charges 3 and 4. They are similar in construction to the cable 12. The lower ends 20, 21 of the conductors of the cable 18 are connected to the terminals of the detonator 6 and the lower ends 22, 23 of the conductors of the cable 19 are connected to the terminals of the detonator 7. When the explosive charge 2 is located in the bore the cable 12 may be tied to a suitable anchor as 26 driven into the ground surface at a suitable distance from the earth bore and its end left free and when the explosive charge 3 is located at the desired place the cable 18 may be tied to an anchor 24 at the ground surface and its end left free and when the next succeeding charge 4 is located at the desired elevation the upper portion of the cable 19 may be tied to the anchor 25 at the ground surface and the end of said cable left free.

As hereinabove indicated the bore is filled with heavy mud laden fluid; or if desired the bore may be filled with the sand or other formation excavated from it during the drilling process and the conductors of the cable 12 are then connected to the blaster.

The blaster 17 may then be operated in the well known manner to complete the circuit between the two electrical conductors which will complete a circuit through the conductors of cable 12 to the detonator 5 and the charge 2 will be exploded. If the bore is filled with fluid this fluid will react against the force of the explosion so as to divert it through the surrounding strata. The anchor next above, being formed of wood, will form a cushion which will materially reduce the liability

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of an explosion of the charge 3 from the force of the explosion beneath and also this anchor will be moved slightly upwardly causing the free ends of the wings 10 to penetrate into the walls of the bore to prevent any substantial upward movement of the charge 3; also the anchors above will reduce the amount of liquid which would otherwise be expelled from the bore as a result of the explosion. A premature explosion is thus avoided.

When the charge 2 has been exploded the container will be completely destroyed and the cable 12 may then be withdrawn from the bore and detached from the firing equipment 17 and the free ends of the conductors of cable 18 may be connected to the terminals of the firing equipment 17 and the charge 3 fired. Thereupon the cable 18 may be withdrawn from the bore and detached from the firing equipment 17 and the free ends of the conductors of the cable 19 may then be connected to the terminals of the firing equipment 17 and the charge 4 fired in the manner and with the results hereinabove explained. If the bore is filled with sand or other earth formation instead of water the results will be substantially the same as hereinabove set forth.

If, upon the explosion of a charge, a cavity is formed in the bore and if the formation above should move downwardly the unexploded charges will be securely held against downward movement by means of the cables to which they are connected.

What I claim is:

In apparatus for seismographic shooting; an anchor for an explosive charge adapted to be lowered into a bore hole and comprising, a support of an approximately triangular shape, in elevation, with an apex pointed downwardly and whose upper end is formed with an approximately horizontal supporting surface, an explosive charge on said surface whose transverse diameter is not substantially greater than the width of said surface, a post secured to one side of, and upstanding from, the support, means for securing the charge to the post, wall engaging members secured to the downwardly converging margins of the support and diverging upwardly from the support and whose free ends are adapted to yieldably engage the wall of the bore to prevent substantial upward movement of the anchor in the bore, said support post and said wall engaging members forming shields for the charge to shield the charge against the force of an explosion in the bore beneath.

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