No. 866,838. PATENTED SEPT. 24, 1907.

L. H. BROADWATER.

APPARATUS FOR FIRING EXPLOSIVES IN WELLS.

APPLICATION FILED JUNE 24, 1907.

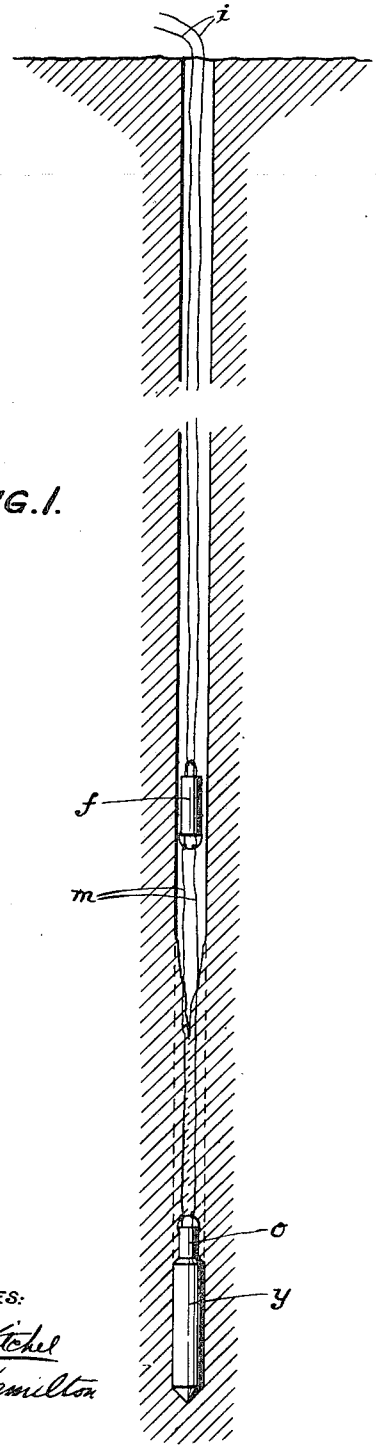
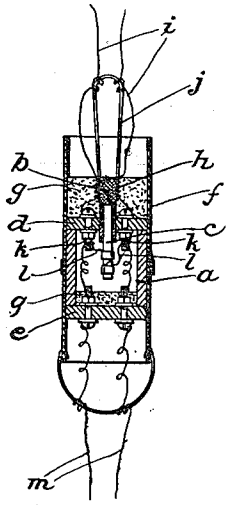


FIG. 1.



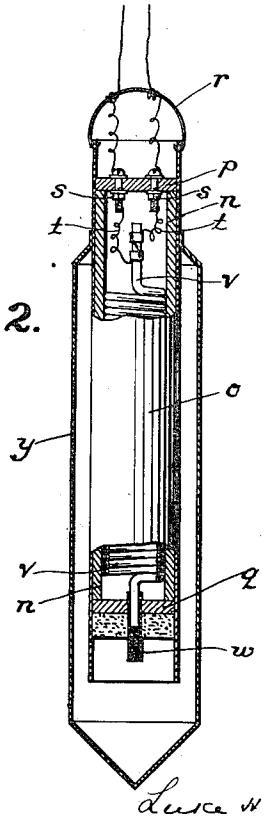


FIG. 2.

WITNESSES:

Robt. Ritchel

M. M. Hamilton

INVENTOR

Lewis H. Broadwater

BY

Manning & Manning

ATTORNEYS.

UNITED STATES PATENT OFFICE.

LUKE H. BROADWATER, OF FINDLAY, OHIO, ASSIGNOR TO THE E. I. DU PONT DE NEMOURS POWDER COMPANY, OF WILMINGTON, DELAWARE, A CORPORATION OF NEW JERSEY.

APPARATUS FOR FIRING EXPLOSIVES IN WELLS.

No. 866,838. Specification of Letters Patent. Patented Sept. 24, 1907.

Application filed June 24, 1907. Serial No. 380,685.

To all whom it may concern:

Be it known that I, LUKE H. BROADWATER, a citizen of the United States, residing at Findlay, county of Hancock, and State of Ohio, have invented a new and useful Improvement in Apparatus for Firing Explosives in Wells, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention consists in certain improvements upon the invention patented to me in Letters Patent of the United States Number 855,224, dated May 28th, 1907. That patent relates to an arrangement whereby, simultaneously with the ignition of the fuse for firing the detonator for the primary charge, an explosive which controls the connection of the firing wires and suspension wires of the apparatus is also fired. The purpose of this is, by making the fuse of some length, to enable the suspension and firing wires to be withdrawn and saved. In the apparatus shown and described in that patent the casing in which is contained the rupturing charge is directly connected with, or contiguous to, the fuse chamber. In practice with very deep wells, after the apparatus has been placed in the well and the well casing removed, in some cases sufficient earth from the side walls may fall in to cover and lock the firing wires and suspension wires above the chamber containing the rupturing explosive, so that it is difficult or impossible to remove the firing wires and suspension wires.

My invention has for its object an improvement in the apparatus to obviate this difficulty.

Speaking generally, I form the casing or chamber containing the rupturing explosive separate from and non-contiguous to the fuse chamber and connect the two chambers by the firing wires alone or firing and suspension wires. By this arrangement the two parts of the apparatus may be separated a distance from each other, a distance sufficient to prevent the firing and suspension wires leading to the apparatus being locked and their withdrawal prevented. This distance may be, say one or two hundred feet or more in a well which may be as deep as two or three thousand feet.

I will now describe the embodiment of my invention illustrated in the accompanying drawings and then point out the invention in the claims.

In the drawings: Figure 1 is a view of my apparatus in a well. Fig. 2 is a detail sectional view of my improved apparatus.

a is the chamber containing the casing *h* in which is the rupturing explosive *b* and its fuse *c*. This casing has the top cap *d* and bottom cap *e* soldered to the surrounding shell *f*. The caps *d* and *e* are covered with retaining material *g*. The firing wires *i* are connected to the bail *j* attached to casing *h* and wound around the casing *h* and are connected to binding posts *k*. From these binding posts *k* wires *l* lead to a resistance in the fuse *c*. Wires *m* also lead therefrom through the cap *e* and extend beyond the desired distance of separation of chamber *a* and the fuse chamber *n*. This fuse chamber *n* has the top and bottom caps *p* and *q*, and the outer casing *o* soldered to the caps. This casing *o* extends above and below the caps *p* and *q*. To the casing *o* is connected the bail *r* around which the wires *m* are wound and then pass to binding posts *s* on cap *p*—, from which wires *t* pass to the resistance in the main fuse *v*. This fuse is in the fuse chamber *n* and its lower end is connected with the detonator *w* in the primary charge which is contained in the vessel *y*. With this arrangement the chamber containing the rupturing explosive and its electrical connection is non-contiguous to the fuse chamber and they may be separated from each other a distance sufficient to insure that the firing and suspension wires, to the first mentioned chamber, shall not be locked by earth caving in from the side walls of the well.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:

1. In an apparatus for firing explosives, in combination, a chamber containing the firing fuse, a chamber, containing an explosive, there being a space between said last mentioned chamber and the fuse chamber, firing wires, adapted to be ruptured by said explosive and electrical connection between said firing wires and the fuse and explosive.

2. In an apparatus for firing explosives, in combination, a chamber containing the firing fuse, a chamber containing an explosive, there being a space between said last mentioned chamber and the fuse chamber, suspension wires, adapted to be ruptured by said explosive and electrical connection to said fuse and explosive.

3. In an apparatus for firing explosives, in combination, a chamber containing the firing fuse, a chamber containing an explosive, said first mentioned chamber being suspended from the last mentioned chamber by firing wires—firing wires supporting the first mentioned chamber, electric connection between the firing wires to the first chamber and the explosive and the firing wires suspending the second chamber, and electrical connection between said last mentioned wires and the fuse.

4. In an apparatus for firing explosives, in combination, a chamber containing the firing fuse, a chamber containing an explosive, suspension wires connecting said chambers, suspension wires for the chamber containing the explosive and electrical connection to said fuse and explosive, said explosive controlling the connection of the suspension wires of the chamber containing the explosive.

In testimony of which invention, I have hereunto set my hand, at Philadelphia, on this 20th day of June, 1907.

LUKE H. BROADWATER.

Witnesses:
M. M. HAMILTON,
A. M. URIAN.