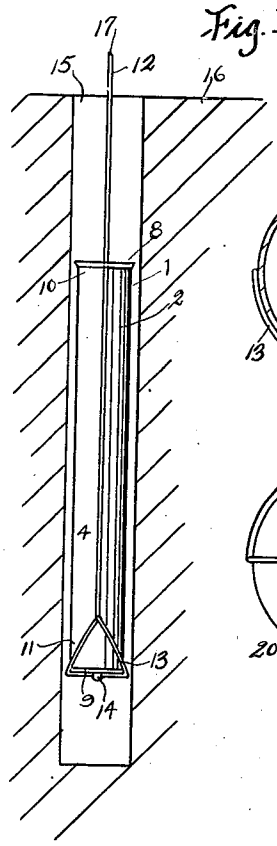
June 3, 1930. C. E. BEDIENT 1,762,044

BLASTING UNIT

Filed Oct. 25, 1928

Fig. 1.



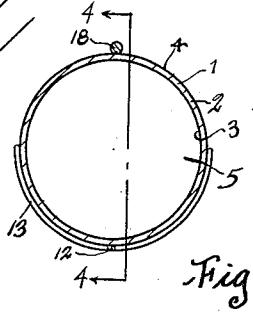


Fig. 2.

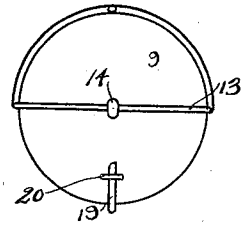


Fig. 3.

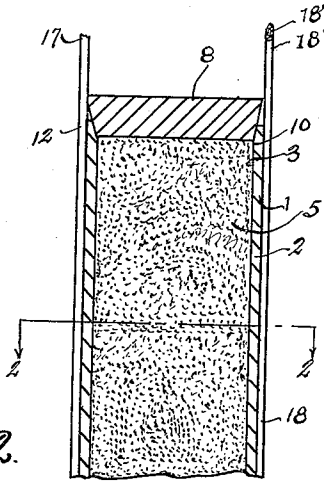


Fig. 4.

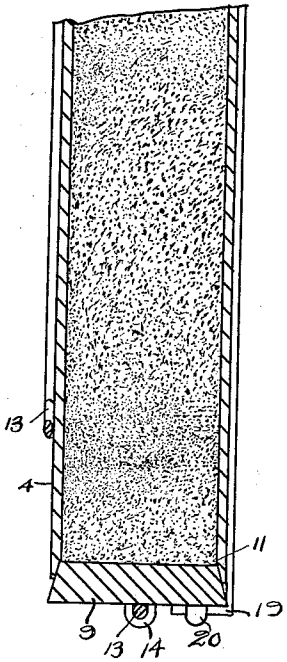
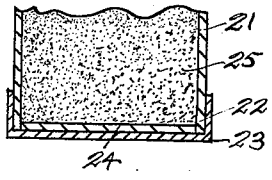


Fig. 5.



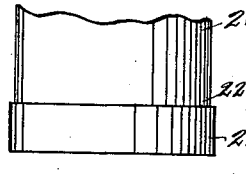


Fig. 6.

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UNITED STATES PATENT OFFICE

CLARENCE E. BEDIENT, OF CINCINNATI, OHIO

BLASTING UNIT

Application filed October 25, 1928. Serial No. 315,086.

The invention relates to a self-contained blasting unit particularly adapted for use in submarine blasting and under-water blasting in deep, drilled holes containing a column of water.

During the past three decades, there has been a very great increase in the use of high explosives, known under the general term of dynamite, due to the enormously increased tonnage of crushed stone produced by quarries for use on highways, concrete construction of buildings, streets, bridges, etc. This has called for a change in blasting methods suited to increase production of stone at the quarries. Formerly, the stone was worked in shallow ledges with short drill holes of an inch to one and one-half inches in diameter and a few feet in depth. Dynamite for this purpose was usually made by inserting a plastic explosive in a thin-walled container made of paper rolled spirally in a tubular form and the closure of the ends made by folding the paper down.

This method of manufacturing blasting units was general several years ago because the drill holes were of small diameter and but few feet in depth, and there was little or no water in the holes.

However, the increased production of stone has necessitated a change in the operation of quarries, and at the present time drills similar to those used for water wells and oil wells are used, and drilled holes from 50 feet to 200 feet are common for this purpose. Sometimes these holes are entirely filled with water. Therefore an explosive impervious to water must be used, of which there is only one type known at present—that known as gelatin dynamite.

The type of pervious explosives, generally called dry dynamites, may be used if suitably protected by a water-proof container. The latter kind of explosives are cheaper to produce than gelatin dynamite and are fully as efficient, if exploded in a dry condition. Examples of such powders are explosive mixtures containing as a base, chlorate of potassium, nitro-starch, nitrate of ammonia, or similar well-known explosive bases.

Since, deep holes, generally drilled at present, are six inches in diameter, the explosive charge of the latter class of explosives inserted in such holes extends from the bottom upward about half the depth of the hole. For instance, the charge in a hole 50 feet deep would be approximately 25 feet in depth. If loaded with gelatin dynamite the charge would comprise about 17 cartridges which are 5 inches in diameter and 18 inches long. These cartridges are individually dropped into the hole, each cartridge being superimposed in a vertical position on the one directly underneath. There are sixteen spaces between adjoining cartridges which act as a hindrance to the speed of the wave of detonation which passes through the charge from one end to the other. It is well known that reducing the speed of detonation lowers the power of the explosive.

Also, explosives containing nitroglycerin, as the ordinary nitroglycerin and gelatin dynamites freeze, harden, or congeal at temperatures approximately 40 to 45 degrees Fahrenheit. The water in drill holes in winter frequently is near the freezing point, and it often happens that the explosive will harden by contact with cold water and will not properly detonate. Furthermore, exposure of the explosive to summer heat while in storage in a magazine, or in transportation frequently causes the nitro-glycerin to exude, and handling while in this condition may cause the explosive to explode.

Therefore, the objects of the invention are to provide a simple, efficient, and economical blasting unit adapted to maintain the explosives free from water when said unit is immersed in water; to construct said unit from materials adapted to increase the explosive power of the explosive contained therein; to

provide a blasting unit with means whereby said unit is adapted to be lowered slowly in a hole; and to provide means whereby the plugs in the ends of the casing of the said unit are unadapted to be loosened and the casing of said unit is unadapted to be distorted or fractured when said unit is lowered into a hole.

The invention consists of a blasting unit comprising a plastic explosive contained in a relatively thick-walled, rigid container; adapted to protect the plastic explosive from blows and concussions during transportation; said blasting unit being composed of the three parts: the plastic explosive, the rigid tubular container made of combustible material, as wood pulp or other form of cellulose, which material forms an essential part of the explosive formula—and tapered plugs to form the ends of the blasting unit, the whole when assembled forming a cylinder of explosive, the outer surface and adjacent portions of which are relatively rigid, impermeable to water and minutely porous, and therefore, a non-conductor of heat and cold, the inner core of the units being formed of a plastic or granular explosive.

The invention also consists in the combination of the elements, arrangement of the parts, and in the details of the construction, as claimed.

In the drawings:

Fig. 1 is a vertical section of the earth having a drilled hole, showing the invention therein;

Fig. 2 is a transverse section of the invention taken on a line corresponding to 2—2 in Fig. 4;

Fig. 3 is a bottom view of the invention;

Fig. 4 is a vertical section of the invention, with parts broken away, taken on a line corresponding to 4—4 in Fig. 2;

Fig. 5 is a vertical section showing a modified form of the invention, with parts broken away; and

Fig. 6 is a side elevation of the same.

In the preferred construction of the invention, I provide the cellulose casing or tube 1 formed from pervious combustible material, such as wood pulp, or the like. The tube is approximately six inches in diameter and twelve feet in length, and its walls 2 are from one-fourth to five-eighths inch thick.

The tube 1 is immersed in melted paraffine which is absorbed in the inner and outer surfaces 3 and 4 of the walls 2 of the tube to a depth dependent upon the temperature and quality of the paraffine and the duration the tube is permitted to remain in the melted paraffine.

When the temperature of the paraffine, which adheres to the tube and is absorbed into the pervious material, is lowered sufficiently to form a solid body, suitable explosive 5, such as black powder, nitroglycerin dynamite, ammonia dynamite, chlorate explosive, or the like, are inserted into the tube.

The tapered plugs 8 and 9, formed from wood, paraffine, or similar material, then are inserted into the upper and lower ends 10 and 11, respectively, of the tube. Then the ends 10 and 11 are immersed in melted paraffine for the purpose of sealing the tube.

The tube 2, containing the explosive 5, sealed by the plugs 8 and 9, is adapted to be inserted, and permitted to remain for a long period, into a drilled hole containing water without the water entering the tube and being absorbed by the explosive 5. Therefore, economical explosives especially adapted to be used in a hole containing no water may be utilized in the blasting unit 1 instead of the expensive gelatine dynamite.

Therefore, there are certain classes of explosives adapted for quarry blasting which are desirable to use particularly because of economy and efficient operation. Generally these latter classes have not been generally adapted and used instead of gelatin powder, because, first, they absorbed moisture from the air on long storage in magazines, which lowered their explosive force, and second, when exposed to direct contact with water in drill holes, their usefulness is disadvantageously affected.

An example of an economical explosive is ammonium nitrate which is very powerful when dry, and safe because it is insensitive to blows or impacts. This explosive was formerly used to a considerable extent, but has now come into disuse, because it readily absorbs moisture when in storage and is rendered practically useless when lowered into water in drill holes.

Nitro-starch is an explosive which may misfire if exposed a day to water in drill holes. This explosive is therefore impractical for use in usual units because in many quarries it is customary to fire a large number of drill holes in one blast, and frequently more than a day to load the holes. Since these holes are frequently half filled with water, the latter kind of explosives must be protected to insure efficient results.

Another class of economical explosives are those of which chlorate or perchlorate of potassium or sodium is the base. These explosives are less subject to absorption of water in storage than ammonium explosives, but they are quickly ruined by direct exposure or contact with water.

Common black blasting powder is still another example of an explosive unadapted to explode with efficient results when wet.

The force of the explosion of the explosive 5 is importantly increased by utilization of the invention, because the paraffine and the combustible cellulose material, from which the tube 2 is formed, are burned simultane-

ously with the explosion thereby forming expandible gases.

To illustrate the manner in which the cellulose tube 2 performs the function of a carbon carrier or combustile agent required in all explosives, the following formulas may be compared:

"A"

75 lbs. potassium chlorate
7 lbs. nitro-benzene
16 lbs. sugar
2 lbs. aluminum

100 lbs.

"B"

75 lbs. potassium chlorate
7 lbs. nitro-benzene
16 lbs. cellulose tube, paraffined
2 lbs. aluminum

100 lbs.

It will be observed that in the Formula "A", the 16 lbs. of sugar is replaced in the formula "B" by 16 lbs. of cellulose tube 2, whereby the tube comprises 16% of the explosives of the unit. The formula "B" is cheaper to use, yet it is more powerful than the Formula "A".

Instead of dropping the blasting unit 1 into a hole in the formation to be blasted, I provide the cable 12 having the looped end 13 received in the staple 14, which is received in the outer portion of the lower plug 9, to maintain the looped end in contact with the lower end of the blasting unit. In lowering the blasting unit into the vertical hole 15, in the ground 16, the lower end of the unit is permitted to enter the hole 15, and the upper end 17 of the cable 12 is gradually and slowly lowered into the hole, whereby the cable extends in contact and parallel with the outer surface of the walls of the tube 2, and by gravitation the unit is permitted to fall at a low rate of speed to the bottom of the hole. In this manner, the lower plug 9 is forced upwardly into the tube 2 whereby the plug is tightened, instead of being loosened in the tube.

Moreover, since the walls of the tube 2 are relatively thick and rigid the blasting unit is unadapted to become distorted or fractured, when it is lowered into a hole, as often results to a blasting tube having thin and flexible walls.

For the purpose of detonating the blasting unit 1, the detonating fuse 18 (comprising a lead tube 18′ containing T. N. T. 18″) has its lower end 19 secured, as by the fastener 20, to the lower plug 9 and extends upwardly, in contact with the outer surface of the tube 2, to the surface of the ground.

In Figs. 5 and 6, I show a modified form of the invention comprising the tube 21 having its lower end 22 received in the metal cap 23. On the bottom of the cap is a layer of paraffine 24 which prevents water from entering the tube and damaging the explosive 25.

An advantage of the invention is that the explosive in the tube is adapted to explode instantaneously, whereas the customary gelatine and nitroglycerin dynamites, packed in paper cartridges, will not explode instantaneously, because the paper forming the ends of these relatively short cartridges is folded in superimposed layers and which are adapted to retard the speed of the wave of detonation, upon which the explosive force partly depends. This is true because the total volume of gases developed is greater in my invention and the period in which the gases are produced is considerably reduced, because the tubes being approximately twelve feet in length, the number of the joints between the explosive are reduced to a minimum.

Still another advantage of the invention is that a plurality of the blasting units 1 may be transported on motor trucks, or other conveyances, when lying on their sides and stocked in parallel relation with each other, without being previously packed in wooden box containers, as is necessary with other kinds of dynamites, because of the thin paper walls of cartridges or precise quantity of explosive.

Still another advantage of the invention is that the blasting unit, being rigid non-metallic casing, enclosing a semi-plastic or granular high explosive, the walls of the casing being of considerable thickness and composed of a cellulose which, with the paraffine coating, not only performs the functions of a water-proof covering to the semi-plastic or granular explosive, but is a non-conductor of heat and cold, whereby the explosive is prevented from hardening due to low temperature in winter and prevents the oils in the explosive from exuding due to the high temperature in the summer.

In the chlorate type of explosives, it is desirable to use a nitrated oil, such as nitrobenzene as one of the ingredients. These oils are highly volatile and volatilize and escape from the explosive composition when subjected to long storage in magazine, particularly when packed in thin walled containers such as the ordinary paper cartridges. Therefore, an important advantage of this blasting unit is that the tube comprises thick-walled cellulose material having hermetically sealed ends which effectively prevent volatilization of nitrated oils, thus retaining their full strength and efficiency during long periods of storage.

It will now be apparent that I have devised a novel and useful structure, which embodies the features of advantage enumerated as desirable in the statement of the invention and the above description, and while I have, in the present instance, shown and described a preferred embodiment thereof which will give in practice satisfactory and

reliable results, it is to be understood that the same is susceptible of modification in various particulars without departing from the spirit or scope of the invention or sacrificing any of its advantages.

What I claim as new and desire to secure by Letters Patent is:

1. A blasting unit comprising a combustible casing having relatively thick and rigid side walls, explosive in said casing, detonating means to explode said unit, said casing comprising a chemical part of the ingredients of the explosives of said unit.

2. A blasting unit comprising a combustible casing having open ends and having relatively thick walls, explosive in said casing, closure means for said ends, said casing and the plugs being saturated with paraffine, detonating means to explode said unit, said casing comprising approximately 16 per cent of the ingredients of the explosives of said unit and being a chemical part thereof.

3. A blasting unit comprising a combustible casing having relatively thick walls, and closure means explosive in said casing, detonating means to explode said unit, said casing being a chemical part of the explosive ingredients of said unit.

4. A blasting unit comprising a casing having rigid walls, explosives in said casing, upper and lower plugs, respectively, in the upper and lower ends of said casing, detonating means connected with said casing, a wire cable fixed to said lower plug whereby said unit is adapted to be lowered into a hole with the lower end of said unit downwardly, said casing being sufficiently rigid to prevent distortion of said unit and being a chemical part of the explosive ingredients of said unit.

CLARENCE E. BEDIENT.