Sept. 22, 1942. W. DE C. CRATER 2,296,504

BLASTING PLUG

Filed July 8, 1939

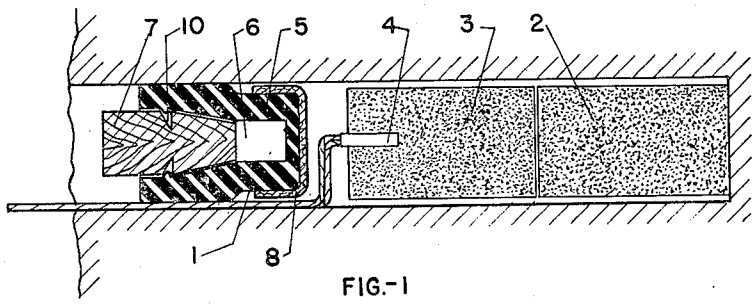


FIG.-1

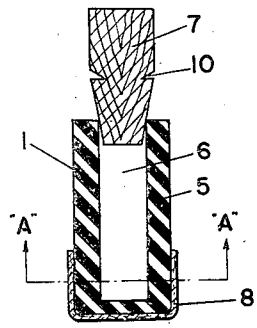


FIG.-2

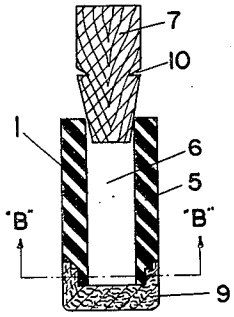


FIG.-4

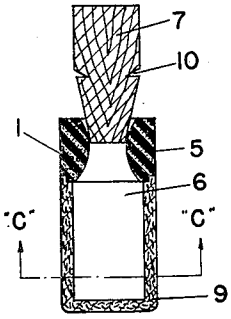


FIG.-6

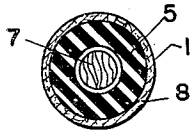


FIG.-3

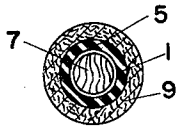


FIG.-5

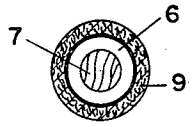


FIG.-7

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BLASTING PLUG

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8 Claims. (Cl. 102—30)

This invention relates to an improved safety blasting plug and more particularly to an improved blasting plug which, while effecting adequate and positive confinement of an explosive charge within a bore hole will not create irritating fumes or obnoxious odors upon the detonation of the explosive charge.

In the explosive art, it has been the custom after loading a bore hole with an explosive charge, for example, dynamite, to fill the remaining space within the hole with stemming. The stemming used in this filling operation is normally fine rock dust, clay or sand, which is tamped tightly into the hole to confine the explosive. A tamping operation has several disadvantages, for example, the tamping stick may cause the firing device lead wires to become short circuited, due to the abrasion between the tamping stick, wall and wires, or the stemming may not be tamped sufficiently tight to cause the explosive to be most effective and the operation in itself is time consuming, inefficient and dangerous.

Because of the various disadvantages encountered in tamping stemming into bore holes, the art has developed the use of blasting plugs. A blasting plug includes an expandible member slightly smaller in diameter than the diameter of the bore hole and a wedge for expanding this member after it is in place. The wedge and expanding member are placed in the blasting hole close to the explosive charge and the wedge then forced into the expandible member to cause effective sealing, by expansion, against the side walls of the hole.

The advantage of using blasting plugs instead of stemming is that it is an extremely simple way of getting a rapid and positive seal for the bore hole. Those skilled in the art consider that the blasting plug gives a much superior seal than is obtainable with the standard tamping and stemming procedure. Another desirable feature of the safety blasting plug is the ease of reprimming misfired holes. The misfired hole may be readily reprimed by inserting a half stick dynamite primer and another safety blasting plug just above the blasting plug of the old charge. This obviates the necessity of drilling an extra hole or cleaning the stemming out of the misfired hole, operations which are not only time consuming but very hazardous.

The blasting plugs now used by the art are not entirely satisfactory due to the fumes which they give off at the time of the explosion. The fumes have been found to be extremely irritating to the eyes and also have a very obnoxious odor. Due to these disadvantages, the use of blasting plugs has not been completely acceptable to the art.

The blasting plugs now known to the art have another very serious disadvantage when used in mines requiring permissible explosives. This disadvantage arises from the fact that all blasting plugs are constructed of combustible material. Thus, upon explosion of the detonating charge, the blasting plug may catch fire, and may ignite any fire damp present and cause disastrous explosions, with possible loss of life.

The object of this invention is to provide a blasting plug which, when used in bore holes, will not create irritating fumes and obnoxious odors, and which is so constructed that there is no danger from the ignition of the plug. A further object of this invention is to produce a blasting plug which will efficiently plug the bore holes and so confine the explosive charge that the burden is properly broken. A still further object of this invention is to produce a blasting plug which may be inserted into the bore hole without danger of causing a short circuit between the lead wires of the blasting cap. Other objects of this invention will appear hereinafter.

In general, the blasting plug of this invention includes a cylindrical member of expandible material such as, for example, rubber and a wedge to effect the expansion thereof. The blasting plugs are, therefore, similar in design to the plugs described in the prior art for example, as by U. S. Patents 2,007,568 or 2,115,388. The plugs prepared in accordance with this invention include within their design and construction an improvement over the plugs of the prior art which alleviates all the difficulties encountered with irritating fumes, obnoxious odors, and ignition after the explosion.

Thus, in accordance with this invention, the plugs are designed in a manner which effectively fireproofs all exposed combustible portions while allowing the expandible member to be constructed in a manner which provides positive and efficient sealing of the bore hole.

The plug in general therefore comprises an expandible plug of rubber which has a central bore into which may be driven a wooden wedge. The plug's anterior end is completely and positively fireproofed by a fireproof coating or by a solid disc of fireproof material. The plug thus comprises an expandible member which is thoroughly fireproofed at the anterior end to prevent

ignition of the plug material and to prevent the formation of irritating or obnoxious fumes.

Having now indicated in a general way the nature and purpose of this invention, there follows a more detailed description of preferred embodiments thereof with reference to the accompanying drawing in which Figure 1 is a cross-sectional view of a bore hole with a dynamite charge and a blasting plug in place. Figure 2 is a cross-sectional view of a blasting plug having the anterior end coated with a fireproof material. Figure 3 is a plan view of Figure 2 taken along line AA. Figure 4 is a cross-sectional view of a blasting plug having a fireproof composition vulcanized to its anterior end. Figure 5 is a plan view of Figure 4 taken along line BB. Figure 6 is a cross sectional view of a blasting plug with ring of sponge rubber attached thereto, and Figure 7 is a plan view of Figure 6 taken along line CC.

A method of using the blasting plug of this invention is diagrammatically shown in Figure 1. Thus, in Figure 1, the blasting plug 1 is positioned above a dynamite charge 2 that includes a priming cartridge 3, having a blasting cap 4 inserted therein.

The blasting plug 1 may be constructed in accordance with Figures 2, 4, or 6. These three figures will be described together with like numerals representing like parts. The blasting plug includes an expandible body 5 of, for example, rubber, which has a longitudinal bore 6 in the posterior end, which is designed to receive an expanding wedge 7. The anterior end of the plug 5 may be coated with a fireproof material 8 as shown in Figure 2, or may have attached thereto by vulcanization or by an adhesive a fireproof composition 9 as shown in Figures 4 or 6.

The wedge 7 of, for example, wood, plastic or similar material, may be designed with notches 10 which engage the side walls of the plug 5 and prevent the wedge 7 from movement once it is tamped into place.

The mode of operation of these plugs will be apparent by reference to Figure 1. The dynamite charge 2 and priming cartridge 3 are placed in the bottom of the bore hole, the blasing plug 1 is then inserted into the bore hole and positioned against the dynamite charge. It will be noted that the combustible section of the plug, when positioned against the dynamite charge, is protected by the fireproof material 8 or 9 which is either coated, vulcanized or cemented to its anterior end. In order to firmly position the blasting plug within the hole, the expanding plug 7, located in the longitudinal bore 6 is tamped tightly into position. The tamping operation expands the sides of the plug walls which closely contact the sides of the bore hole and engages the notches 10 with the side walls 5 of the plug. This contact between the plug and the bore hole provides a secure and definite means of retaining the blasting plug in position and effectively seals the bore hole.

The plugs described above preferably have the expandible member formed from rubber, but this member may be made from any suitable rubber substitutes such as the synthetic rubbers now on the market or like material. The wedge which is used in accordance with this invention is preferably made of wood but may be made of plastic or resinous material. While it is possible to use metal wedges such is not desirable due to the hazard of striking sparks or creating undue friction.

The fireproofing coatings which I may use are materials such as, for example, asbestos fiber, diatomaceous earth, zinc phosphate, rock wool, or the like, while for binders I may use any of the various cementing materials such as sodium silicate, phosphoric acid, magnesium oxychloride or the like.

If a molded fireproof anterior end is to be attached to the plug I may form the member from m xtures of materials such as, for example, plaster of Paris, diatomaceous earth, whiting, asbestos, cement, pumice, clay, etc. with suitable binders if necessary. These molded members may be air dried or may be baked to effect the correct strength.

To further show the method of manufacture of my improved blasting plug, a few specific examples are given below.

In the manufacture of the blasting plug of this invention shown in Figure 1, a coating is placed on the anterior end of the plug. The coating which I prefer to use in my invention comprises approximately the following composition: a 50% sodium silicate-water solution, 65 parts by weight and asbestos fines, 26 parts by weight. The plug to be prepared is dipped into the above composition, and then dried either in an oven or at room temperatures. It will be apparent that the formation of a coating on the plug of this invention may be accomplished by dipping, spraying, painting, or similar operations. The physical properties of the fireproof coating to be used and the size of the plug to be coated will control the process which I use and, therefore, it is to be understood that I contemplate adapting the process to the coating material and to the plug being coated. In order to effect a more positive fireproofing of the plug, I may redip the blasting plug, any desired number of times.

Other compositions which I have found effective as fireproofing coating agents in the above method may be prepared as follows:

An intimate mixture of 50 parts by weight of diatomaceous earth and 17.5 parts by weight of zinc phosphate was stirred thoroughly into 32.5 parts by weight of about 60% phosphoric acid. This composition was of the proper consistency for use as a dipping solution and adhered tenaciously to the plug upon drying. The composition could be used as a spray by further dilution.

Another very effective dipping or spraying solution was prepared by intimately mixing 20 parts by weight of Asbestine (commercial asbestos of extremely short fiber length) and 80 parts by weight of magnesium oxychloride cement and diluting with water to the desired consistency.

In the manufacture of a blasting plug, the anterior end of which is vulcanized or cemented to a fireproof composition, as shown in Figure 4, I prefer to proceed as follows: A fireproof composition is prepared from plaster of Paris and medium length asbestos fiber. This composition is molded into any desired shape. The usual cross-sectional area being round and slightly smaller in diameter than the bore hole in which it is to be used. The design may be varied from disc shape as shown in Figure 4 to the U or "cup" shape shown in Figure 6. After forming into the proper shape the molded article is thoroughly dried either in an oven or at room temperature. After drying, the molded material is placed in the bottom of a suitable mold and the upper surface is preferably primed with a rubber priming

solution. Sufficient weight of uncured rubber stock is put into the mold above the fireproof composition and the mold closed. Upon heating, the rubber flows evenly through the mold and keys into the fireproof composition on the bottom. It becomes vulcanized in this position so that when the plugs are discharged from the mold, the fireproof composition is found to be tightly vulcanized to the remainder of the plug.

To manufacture a blasting plug, as shown in Figure 6, I prefer to proceed in accordance with the method described above with the exception that the rubber composition used should be of the type and quantity that will puff up and sponge during the vulcanizing operation.

An alternative method of preparing the plugs shown in Figures 4 or 6 is to cement a ring of cured plain or sponge rubber on the molded anterior fireproof end by means of a suitable adhesive. I have found the vulcanizing process described hereinbefore to be the preferable method of joining the two sections, but the cementing of the molded anterior fireproof end is operable in either the plug of Figure 4 or 6.

Other compositions which I have found effective as molding material for preparing the molded fireproof anterior end of the blasting plug of this invention may be prepared as follows:

An intimate mixture of 60 parts by weight of plaster of Paris, 30 parts by weight of diatomaceous earth and 10 parts by weight of asbestos, medium fiber, is made into a paste by adding water, molded to the desired shape, and thoroughly dried in an oven. The molded article will have sufficient strength to withstand normal handling and very efficiently prevent the flame of the explosion from reaching the rubber section of the blasting plug.

A mixture of 50 parts by weight of whiting, 20 parts by weight of asbestos, medium fiber, and 30 parts by weight of sodium silicate was molded into the desired form and baked in an oven.

A mixture of 30 parts by weight of pumice, 20 mesh, and 70 parts by weight of clay, 100 mesh, was made into a moldable paste by adding water, formed as desired and fired in a kiln.

A mixture of 17 parts by weight of asbestos, medium fiber, and 83 parts by weight of Portland cement was made into a paste by adding water, molded under high pressure, and thoroughly dried.

It is to be understood that the above methods of manufacturing blasting plugs and the compositions described are not limiting on my invention, but serve only as illustrative examples.

What I claim and desire to protect by Letters Patent is:

1. A blasting plug comprising an expandible, non-metallic, substantially cylindrical member, the anterior portion thereof coated with a fireproof material.

2. A blasting plug comprising an expandible, non-metallic, substantially cylindrical member, the anterior portion including a coating of fireproof material and a binding agent.

3. A blasting plug comprising an expandible, non-metallic, substantially cylindrical member, the anterior portion including attached thereto, a molded fireproof material.

4. A blasting plug comprising an expandible, non-metallic, substantially cylindrical member, the anterior portion including attached thereto a molded fireproof section comprising a fire resistant material and a binder.

5. The blasting plug of claim 3, the said coating comprising asbestos fiber and sodium silicate.

6. The blasting plug of claim 5, the said molded section comprising plaster of Paris and asbestos fiber.

7. A blasting plug comprising an expandible, non-metallic, substantially cylindrical member, adapted to be inserted into a bore hole, containing an explosive charge and fireproofing means integrally attached to the anterior end of the said expandible member which is the end of the plug nearest the said explosive charge whereby the ignition of the expandible member is prevented.

8. A blasting plug comprising a body of yielding rubber adapted to be inserted in a drilled hole in the lower end of which an explosive has been placed, said body having a recess in its outer end and a tapered insert normally seated in said recess and adapted to be forced deeper into said recess for expanding the external periphery of the outer end of said plug into compressed relation to the walls of said drilled hole, a fire-proofing material integrally attached to the end of said plug nearest said explosive whereby the ignition of the body is prevented.

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