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SHEATH FOR EXPLOSIVES

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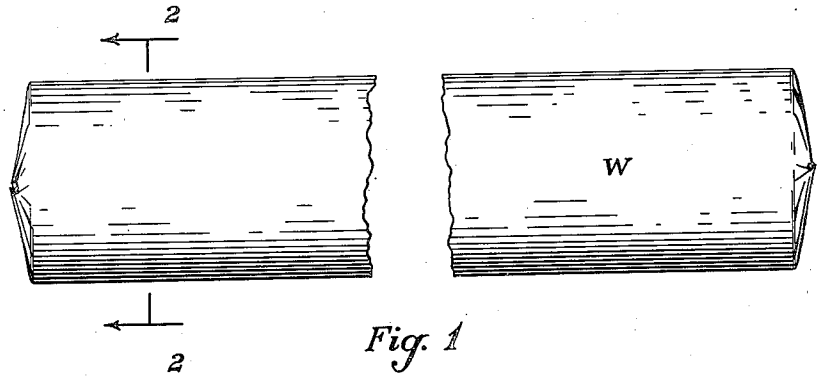


Fig. 1

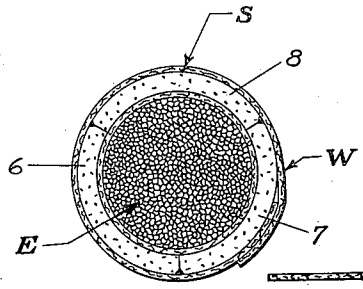


Fig. 2

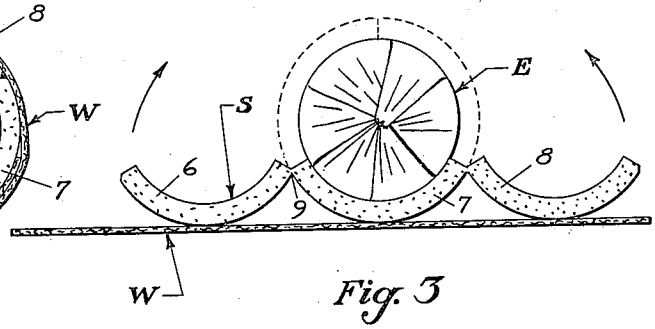


Fig. 3

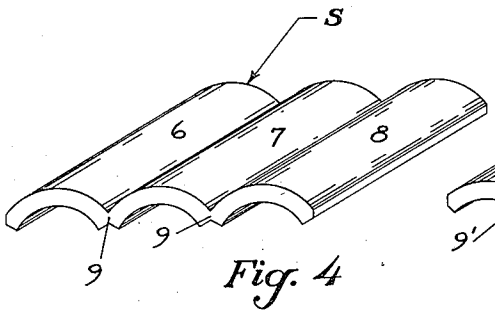


Fig. 4

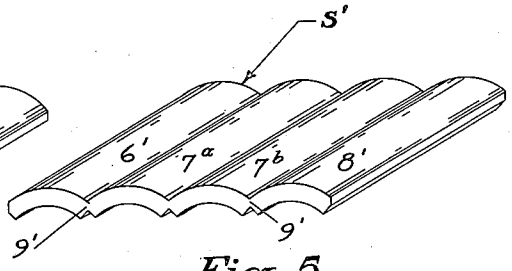


Fig. 5

Iver C. Wood
INVENTOR.

BY H. A. McGrew
ATTORNEY

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SHEATH FOR EXPLOSIVES

Iver C. Wood, Denver, Colo., assignor to The Denver Fire Clay Company, Denver, Colo., a corporation of Delaware

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This invention relates to sheaths for stick explosives and more particularly relates to sheath assemblies applied to dynamite cartridges for flame quenching, cushioning, and/or similar purposes.

In using explosives in underground mining operations, it frequently is desirable to enclose the explosive charge and particularly dynamite sticks in a composition of the type having flame-quenching properties, in order to minimize the danger of igniting gas pockets in the deposit. Also, to increase the production of lump coal by reducing the amount of shattering, it is sometimes desirable to cushion the effect of the blast and the covering compositions may be utilized to perform this function as well.

Regulations in some states require the use of encased dynamite in underground operations and the explosive manufacturers have developed a number of different types of casings for the stick explosives. Various combinations of ingredients have been developed which are satisfactory for the intended purpose, but the development of a satisfactory method for forming such compositions into a satisfactory casing presents many difficulties.

One method which has been used involves the steps of forming the ingredients into a wet mass and then subjecting this mass to an extruding operation to produce the casings of required contour and thickness. However, any considerable amount of moisture in the casing will have deleterious effects on the explosive, causing it to set, and decreasing its strength and sensitiveness. As the aforesaid extruded material has too high a moisture content to be placed immediately in contact with the explosive composition, a drying operation is required.

If rapid drying is employed, the temperatures attained have a destructive effect on the flame-quenching ingredient, such as sodium bicarbonate, which render the composition unsuited for its intended purpose. If natural drying or slow, artificial drying is resorted to, the storage, equipment and handling costs of such an operation place an excessive cost on the finished article.

Binders of bituminous material capable of being softened by heat have been used to render the sheath plastic and moldable. This type of binder however has the disadvantage of being combustible and productive of poisonous gases upon detonation.

Another expedient that has been attempted is to provide a paper cylinder in which an explosive stick of lesser diameter is inserted and then the space between the stick and the cylinder is filled with the flame-quenching composition. This operation involves maintaining the composition in loose condition while filling and even when well packed in this operation, the composition does not have sufficient rigidity to satisfy the requirements for transportation and installation.

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Paper sheaths impregnated with water-soluble cooling salts and designed to be wrapped around the dynamite cartridge are also known to the prior art. These likewise have the disadvantage of being largely combustible and adding to the toxicity of the fumes.

It is an object of the present invention to provide a simple, durable and efficient sheath for stick explosives which possesses sufficient stability to satisfy all the usual requirements for transportation and installation and which has a very low moisture content.

Another object is to provide a moldable sheath of such form and composition that it may be molded in a substantially dry state requiring no subsequent drying.

Still another object of the invention is to provide a novel type of sheath for stick explosives which facilitates the sheath encasing operation, whether performed manually or by machine.

A further object of the invention is to provide a sheath of reasonably low density for stick explosives which provides a substantially rigid casing therefor of substantially uniform thickness and composition throughout its length.

Still another object of the invention is to provide a novel design of sheath for stick explosives which may be transported to a place of use in a substantially flat position to conserve shipping space and which assumes a tubular shape in use.

Other objects reside in novel details of construction and novel combinations and arrangements of parts, all of which will be fully described in the course of the following description.

A variety of compositions may be selected as suitable for the practice of the present invention. Functionally, the ingredients comprise a flame-quenching ingredient, a filler material and a binder. Sodium bicarbonate is well suited for the flame-quenching effect and many of the regulations require that it be present in the composition in a quantity not less than 50% of the total content. Other flame-quenching salts which may be used for this purpose include sodium chloride, borax, sodium thiosulfate, and ammonium sulfate.

In order to minimize the amount of noxious

fumes, i. e. carbon monoxide, produced upon detonation, the ingredients of the sheath should be essentially non-combustible. Not more than about 5% to 10% carbonaceous material may be used, as amounts appreciably greater than this would probably cause the blasting assembly to produce more noxious gases upon detonation than are allowed by the U. S. Bureau of Mines for a permissible explosive. From about 5% to about 10% of bulky, fibrous carbonaceous material such as sugar cane bagasse, wood pulp, straw, cotton fibres, etc., are desirable as ingredients of my sheath as they add bulk and achieve the result of binding the powdery ingredients together.

The filler should be essentially inert and non-combustible and may comprise clays such as bentonite or gaolin, minerals such as vermiculite or expanded mica, expanded perlite or pearlstone, fuller's earth or diatomaceous earth, asbestos, pumice, or manufactured bulky fillers such as expanded sodium silicate or silica bubbles, rock wool, mineral wool, glass wool, or specially prepared smelter slag.

The binder which cements the dry pulverulent materials together may be dextrine, sodium silicate, glue, cement, plaster of Paris, or clay moistened with a little water. I have found that the mixture comprising sodium bicarbonate, expanded vermiculite, bentonite, bagasse, and dextrine, moistened with a little water has excellent binding properties when essentially dry, probably because of the flexible nature of the flakes of vermiculite which appear to interlock and hold the entire mass together.

A suitable combination of such ingredients is selected for forming the sheath. This is presented for illustrative purposes only and it is not intended that I be limited thereby. For example, a composition comprising 52% sodium bicarbonate, 21½% expanded vermiculite, 16½% bentonite and 10% bagasse may be thoroughly intermixed, and then 95 parts of this mixture may be mixed with 5 parts of water to form a pliable mass.

This mass is placed in suitable molds and compressed into the shapes constituting the sheaths of the present invention. Hence, the terms "molded" and "molding" as used herein are intended to cover compressing material in a mold as well as molding or shaping plastic material. The features of the mold assembly and operation comprise a separate invention, for which reason they have not been shown and described herein. This working of the mass as aforesaid, results in some natural drying and by the time the sheath members are completely formed, their moisture content is within the limits prescribed for such articles and no subsequent drying is necessary or advisable.

The accompanying drawings illustrate typical embodiments of the present invention and the practice of the invention will be best understood by reference thereto. In the drawings, in the several views of which like parts have been designated similarly,

Fig. 1 is a broken side elevation of a stick explosive encased in a sheath embodying features of the present invention;

Fig. 2 is a section taken along the line 2—2, Fig. 1;

Fig. 3 is an end elevation of a sheath embodying features of the present invention with a stick explosive supported thereby and illustrating stages of the encasing operation;

Fig. 4 is a perspective view of a sheath constructed in accordance with the practice of the present invention; and

Fig. 5 is a perspective view of another form of sheath constructed in accordance with the practice of the present invention.

As shown in Figs. 1 and 2, the article sold in commerce and used in blasting operations comprises a stick explosive E encased within a tubular sheath S and held by a wrapping W of paper or similar material fastened as by folding its ends, by gluing, or in any other suitable manner.

The sheath S comprises three segmental sections 6, 7 and 8, each of substantially equivalent dimension, and held together along adjoining edges by a common portion 9. In assembling the unit shown in Fig. 1, the sheath S is placed on the wrapping member W as shown in Fig. 3, and the explosive cartridge E is placed on the intermediate section 7, after which the sections 6 and 8 are folded upwardly to form the tubular enclosure indicated by the dotted line positions, sections 6, 7 and 8 thereby being detached from each other by rupture of their common portions 9, and the wrapping member is next wrapped around the sheath and its ends folded or is otherwise sealed to complete the enclosure. Alternatively, the segmental sections may be folded around the dynamite cartridge and the whole encased in a preformed paper tube.

Under some circumstances, it will be preferable to employ a four-section sheath and such a sheath S' is shown in Fig. 5. The end sections 6' and 8' enclose two intermediate sections 7*a* and 7*b*, and the adjoining sections have common portions 9' maintaining the integral character of the unit.

In all the forms, the tubular sheath provides an adequate degree of rigidity to satisfy the requirements, and by maintaining the low moisture content during the forming operation, the sheath is ready for use as soon as it leaves the mold. When it is necessary to ship the sheaths to a distant point of assembly they can be nested together and packaged in an essentially flat condition to conserve shipping space.

In the moisture content control, it has been found that if the moisture transfer to a stick explosive is not appreciably over 1% by weight of its content, the aforementioned deleterious effects do not result. Consequently, if the moisture content of the sheath at the time of formation does not exceed 10% and preferably is held to about 5%, the amount of moisture transfer resulting from its subsequently being maintained in contact with the stick explosive will not exceed the permissible 1% limit.

While the drawings illustrate 3 and 4 section arrangements, it will be apparent that a lesser or a greater number may be used. However, when a two-section arrangement is used, it is difficult to maintain the uniformity of thickness or density that is attained with a flatter section. I have found that when only two semi-circular segmental sections are used the sheathing mixture is not distributed uniformly in the pressing operation and defective fragile sheaths result which vary in thickness and density. In all the preferred forms, the interior surface of the sheath is so shaped that when the sections are folded into a tubular enclosure, the inner wall thereof is substantially a true circular contour and can be drawn into close fitting or snug relationship to the cartridge.

In all these forms, the various enumerated ingredients may be selected to vary the compo-

sitions within prescribed limits to produce sheaths having the aforesaid properties, and so long as the moisture content is held within the prescribed limits the sheaths are adapted to be used as soon as formed.

When an explosive of the type shown in Fig. 1 is used in underground blasting operations, as in coal mining, a hole is drilled or otherwise formed in the structure, into which the explosive is to be inserted. The powder man prepares the explosive for firing by punching a small hole in the end of the cartridge, into which an electric blasting cap is inserted. Sand, clay, or other inert material is tamped in front of the explosive through the outer end of the hole. The charge is then fired by electricity, and in the resulting blast, the sheath, and particularly its sodium bicarbonate content, smothers or dampens the flame without undue diminution of the force of the blast. The hot gases resulting from the explosion of the dynamite are thus cooled, not only by reason of the heat taken from them and utilized in the decomposition of the sodium bicarbonate to sodium carbonate, water, and carbon dioxide, but also by absorption of heat by the inert ingredients of the sheath.

The aforesaid sheath designs provide an integral mass of material of substantially uniform composition and thickness encasing the explosive. Consequently, when only a cushioning effect on the blast is desired, the composition may be changed by substituting more filler for the flame-quenching ingredient and forming the sheath with thinner walls or segments. When dynamite is enclosed in a sheath of the nature described and fired in a borehole, or simply surrounded by a cushion of air as when it is loaded in an oversize borehole, the disruptive effects of the explosive in the immediate vicinity are much lessened. This has the practical effect of reducing the shattering of the coal and increasing the percentage of large sizes of lump coal blasted down. Sometimes it is desirable to cushion the shot in this manner to take advantage of the higher selling price of prepared sizes of coal.

It will be understood that the ingerdients selected for formation of any of the above-described sheaths must be substantially inert, at least to the extent that they will not react with each other, even when maintained in intimate contact over protracted periods. At the same time the sheath ingredients must have no deleterious effect on the explosive itself which is in close juxtaposition, separated from the sheath only by the original explosive cartridge wrapper. The preferred composition previously described satisfies these requirements as it is substantially inert at normal atmospheric temperatures.

The preceding description and the accompanying drawings are intended to disclose typical examples of the practice of the invention, the scope of which is set forth in the hereunto appended claims.

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

1. A molded sheathing for an explosive cartridge comprising a flame quenching composition formed into a plurality of cylindrical segments with their outer convex surfaces tangent to a common plane, said segments being of substantially uniform thickness and integrally joined along their contiguous outer edge portions, the inner concave surfaces of said segments being separated by a V-shaped groove, each of said inner surfaces comprising a like fractional portion of a circular cylinder, said sheath being adapted to be broken along said contiguous edge portions and placed around a cylindrical explosive cartridge with the edges of said groove in abutting relationship to form a closed cylindrical sheath.

2. A molded sheathing for an explosive cartridge comprising a flame quenching composition comprising 95% of the following dry ingredients, sodium bicarbonate, expanded vermiculite, bentonite, bagasse, and dextrine, and 5% water thoroughly intermixed with the dry ingredients and formed into a plurality of cylindrical segments with their outer convex surfaces tangent to a common plane, said segments being of substantially uniform thickness and integrally joined along their contiguous outer edge portions, the inner concave surfaces of said segments being separated by a V-shaped groove, each of said inner surfaces comprising a like fractional portion of a circular cylinder, said sheath being adapted to be broken along said contiguous edge portions and placed around a cylindrical explosive cartridge with the edges of said groove in abutting relationship to form a closed cylindrical sheath.

3. A molded sheathing for an explosive cartridge comprising a flame quenching composition adapted to be formed into a sheath of substantially uniform thickness, the outer surface of said sheath comprising a plurality of contiguous cylindrical segments tangent to a common plane, the inner surface comprising a plurality of cylindrical surfaces concentric to said outer surfaces and separated by V-shaped grooves, the edge portions of said sheath being partially bounded by radial planes whereby said sheath may be broken into a plurality of cylindrical segments to form a closed cylindrical sheath with the adjacent edges of said segments in abutting relationship.

IVER C. WOOD.

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