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WRAPPING FOR EXPLOSIVES

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This invention relates to a new and improved type of wrapping for blasting explosives; particularly to the type of wrapping that forms a blasting integral part of an explosive cartridge and also to the type of wrapping that forms an envelope for one or more blasting explosive cartridges. The chief object of the invention is to provide a novel, practical combustible wrapping which will reflect a high percentage of the sun's rays and other heat rays. Further objects will become apparent with the following description of my invention such as for example (1) the provision of a wrapping which will appreciably increase the available power or energy of the explosive assembly, (2) the provision of a wrapping which will make for a more dependable fume situation for good fume dynamites, (3) the provision of a wrapping which will improve the fumes of highly hygroscopic dynamites, (4) the provision of a wrapping which will protect the dynamite under very wet conditions, (5) the provision of a wrapping not penetrated by the liquid ingredient or ingredients of the explosive, (6) the provision of a wrapping which will not discolor a white or light colored material, for an example salt, in which the explosive is used, (7) the provision of a wrapping of such resilience and toughness as to be readily handled by conventional shell forming and packing machines and having improved heat ray and moisture penetration resistance.

Among the common types of blasting explosives are dynamites. These so-called dynamites usually comprise one or more solid and/or liquid explosive compounds, such as nitroglycerine, nitroglycol, nitropolyglycerine, dinitrotoluene, trinitrotoluene, nitrocotton, nitrostarch and the like; one or more oxygen carrying salts, such as ammonium nitrate, sodium nitrate and the like, and one or more fuels, such as sulphur, starch, charcoal, wood meal, vegetable ivory meal, bagasse pith and the like. They may be granular, fibrous, free flowing, semi-gelatinous or gelatinous in character.

These dynamites are usually wrapped in paper which is given one or more treatments of paraffin wax, to protect them from moisture and to prevent any free liquid ingredient of the dynamite from leaking through or penetrating the paper. This wrapping affords only very little, if any, protection to the dynamite contained in it, from the sun's or other heat rays, as it does not reflect them to any appreciable extent. Thus, it is very hazardous to expose a dynamite with its waxed paper wrapping directly to the sun's rays for it is apt to become heated enough to cause it to catch fire and possibly detonate. For years users of dynamites and other types of explosives have been warned not to expose their explosives to the direct rays of the sun because of the great danger just mentioned. In cool climates this warning can be heeded without much difficulty but in hot climates where the sun is very intense the year around, it is more difficult to heed this warning.

As a readily combustible metal that is highly reflective to sunlight and other heat rays and suitable for use in wrapping dynamites, I will cite, as an example, metallic aluminum. By actual test I have found that dynamite shells comprising aluminum foil offer much more protection, to their contents, from sun and other heat rays, than the ordinary shells consisting of paraffin and paper.

Another advantage in the use of aluminum foil in a wrapping for dynamites is that it will increase the explosive strength of the dynamite assembly appreciably more than the customary wrapping of waxed paper. This is due to the fact that when the explosive reaction takes place the aluminum on burning to Al_2O_3, does so at a much higher temperature, thus expanding the gases more than the ordinary wrapping does in burning.

Still another advantage in the use of aluminum foil in a wrapping for dynamites is that it makes for a more dependable fume situation in good fume dynamites than does the customary wrapping of waxed paper as will be seen in the following line of reasoning:

In underground work, especially where good ventilation is almost impossible of attainment, it is quite important to use a dynamite assembly which will, on detonation, result in the generation of only a slight amount, if any, of poisonous gases, especially carbon monoxide and nitrogen oxides. Therefore, when a formula is devised for a good fume dynamite, for underground work, sufficient oxygen is included in the dynamite proper to theoretically, completely burn both the dynamite proper and the wrapper, without the development of any appreciable amount of poisonous or objectionable fumes. Now, in case a part of a waxed paper wrapper is torn away on placing the assembly in the bore hole or a part or whole of the waxed paper wrapper is rendered partly incombustible by water in the bore hole, there will be an excess of oxygen, free to combine with a part of the nitrogen during the explosive reaction. This will result in the formation of nitrogen ox-

ides which are both poisonous and irritating. When a wrapping comprising aluminum foil is used in place of all or part of a waxed paper wrapping, there will be less nitrogen oxides formed, when a like weight of wrapper is torn off. The powder alone need not have such an oxygen excess, as aluminum does not require as much oxygen for complete combustion as waxed paper and there will be less oxides of nitrogen formed, due to wet bore holes since water has no wetting effect on aluminum. The latter fume development advantage of the aluminum wrapping over the waxed paper wrapping is of great importance because it does away with an uncertainty, since wet bores are not always detected, and because it overcomes an undesirable condition resulting from wet bore holes. When a waxed paper wrapping is used under wet conditions it is known that bad fumes will result.

Another advantage in the use of aluminum foil in a wrapping for explosives is that it will greatly improve the fumes of highly hygroscopic dynamites. For example, I have found a 1¼" x 8" shell, made from 0.001" plain aluminum foil and requiring approximately 2.8 grams of oxygen to burn it completely, to offer practically the same moisture protection to the explosive as the regular paraffined and redipped paper shell of like dimensions, requiring approximately 30 grams of oxygen to burn it completely.

Another advantage in the use of aluminum foil in a wrapping for explosives is that it will lengthen their life appreciably more than the regular paraffined paper wrapping when they are immersed in water. In a test which I made, I found that a good fume ammonia dynamite of gelatinous character, packed in the ordinary wrapping of paraffined paper and immersed in several feet of water began to swell and soften after a few days, whereas some of the same gelatin packed in a wrapping comprising aluminum foil apparently underwent no change in character or volume even after several more days of immersion in the same depth of water.

Another advantage in the use of aluminum foil in a wrapping for explosives is that it is not apt to darken the material in which the explosive is used. In salt mining it is very important that the darkening of the salt by the exposive reaction be kept at a minimum. An aluminum wrapping should not stain the salt during the explosive reaction as the oxide of aluminum is white, the chloride of aluminum is colorless and aluminum metal itself is a light gray. Consequently it may be said that the ash is substantially white.

The waxed paper wrapping commonly used on dynamites is intended, besides acting as a container for the dynamite and protecting it from moisture, to keep any liquid explosive ingredient or ingredients from leaking to the outside. However, I have found, on many occasions, liquid explosive ingredients to penetrate or leak through this wrapping. Also, I have found these ingredients to badly stain this type of wrapping. Both conditions just mentioned are very undesirable from a hazard standpoint, especially if the assemblies are exposed to direct sunlight for a short length of time or to a rubbing action. Also both conditions are objectionable in that the hands of the users of the dynamite assemblies are quite apt to come in contact with the liquid explosive ingredients thus causing headaches or other unpleasant feeling. In numerous tests, which I have made with aluminum foil, I have not found it to be either penetrated or stained by the liquid explosive. Thus, another advantage in the use of aluminum foil over that of waxed paper in a wrapping for dynamites, is apparent.

I do not wish to limit my invention to the form and thickness of aluminum described heretofore but wish to include various types which will accomplish the same purpose. Some examples of these types are: (1) plain aluminum foil ranging in thickness from 0.0002 of an inch to 0.0025 of an inch, (2) embossed aluminum foil, (3) a laminated wrapping comprising one or more layers of aluminum foil attached to one or more layers of a more resilient material than the said aluminum foil as paper, rubber, latex, and the like; with or without an auxiliary binding medium as wax, lacquer, shellac, varnish, glue, tar, asphalt, gum, silicate, etc. I have found by actual test that either plain or embossed aluminum foil fastened to a layer of paper, with paraffin as the binder, makes a very satisfactory wrapping. I also contemplate the use, however, of a laminated wrapping wherein no auxiliary binding medium is included as where the more resilient layer is of such nature that it may be intimately attached or bound to the aluminum layer without the aid of an additional binding medium, or where the aluminum and more resilient layers are held in contact with each other in such a manner as to permit their being handled and folded into shell form as a single sheet or web of material, and (4) aluminum paint either sprayed or painted in the form of a continuous layer on either a plain paper or a paper treated with one or more of the adhesives just mentioned.

The last two examples have been found, in actual practice, to be particularly valuable. While the use of aluminum foil alone has the advantages attributed to it in the preceding description, aluminum or metal foil alone has limitations from a practical and commercial standpoint, in that, while it can be fashioned into a package if care is used and if it is handled gently, it does not have the resilience, toughness and tearing resistance to adapt it for use in the conventional machines used in forming and packing the jackets of dynamite cartridges. By reinforcing the aluminum foil with a separate sheet of paper, to which the foil may be fastened, as for example, with paraffin, or by applying an aluminum paint upon a sheet of plain paper or upon a paper rendered waterproof and tough by treatment with one or more of the adhesives above mentioned, I produce an article having many of the advantages of the aluminum alone, as for example its high heat and moisture-penetration resistance but also having such toughness and resilience and resistance to tearing strain as to adapt it to be manipulated in conventional jacket forming and filling machines of the character commonly employed in the manufacture of dynamite cartridges or sticks. Embossed foil is preferable to plain foil for my use, in that it takes the printing of cartridge data much better and makes for a much better appearance in the finished cartridge. Further, the coating of a sheet of aluminum foil with rubber, latex, or similar resilient materials, as described, lends increased strength, toughness and resilience to the aluminum sheet. Aluminum sheets alone lack the springy characteristics necessary to easy handling in shell forming machines. When deformed, aluminum foil remains deformed, and does not tend to resume its former shape. Therefore, I add to the foil a medium adapted to impart the necessary degree of springiness or re-

silience to said foil to render it possible to manipulate the same in conventional shell forming machinery.

I am aware of the fact that in the French patent to Thomas. No. 398,033, granted March 13, 1909, there is suggested the use of thin sheets of aluminum and that these may be varnished. However, an ordinary brittle varnish would add nothing to the toughness or resistance to tearing strain of the sheet, whereas a coating of rubber or latex, constituting a tough, pliable, resilient or springy coating web, as a backing for the aluminum foil, would yield the necessary toughness, resilience and resistance to tearing strain to render it possible to manipulate the foil in conventional machines.

Also, I do not wish to limit my invention to the use of aluminum metal only, but wish to include any other readily combustible metal or alloy that is heat reflectant and that is not hazardous to use as a wrapping or partial wrapping for explosives.

Further, I do not wish to limit my invention to the use of a readily combustible heat reflecting metal as a wrapping for dynamites only, but wish to include it as a wrapping for other types of explosives both of the high and low types. In the latter type I have special reference to black powder in any form.

And also, I do not wish to limit my invention to the use of a readily combustible heat reflecting metal as a wrapping, forming an integral part of an explosive, but wish to include it as a wrapping or envelope for a multiplicity of cartridges. In this respect it can be used advantageously as a case liner for explosive cases. Some of the advantages in its use, over that of regular paraffined paper, as a case liner for explosive cases, are: (1) more protection to the explosive from the sun's and other heat rays, (2) better protection of the explosive from moisture, and (3) that the wrapper is not penetrated or stained by any liquid ingredient in the explosive.

Having described my invention, what I claim is:

1. An explosive package comprising a body of explosive material having a liquid ingredient and an enclosing case for the same consisting of an outer exposed sheet of embossed aluminum foil, an inner sheet of paper much more resilient than the metal foil and lying in close contact with said foil, and a waterproof adhesive coating between and uniting the paper and foil with such intimacy that the resilience of the paper is imparted to the foil, while the whole is additionally waterproofed by the said adhesive material, the outward disposition of the metal foil causing said foil to serve to reflect light and heat rays from the package.

2. An explosive assembly comprising a body of explosive material having a liquid ingredient and a wrapper for the same comprising an outer layer of embossed aluminum foil and an inner layer of a more resilient and springy material.

3. An explosive assembly comprising a body of explosive material having a liquid ingredient and a wrapping material for the same comprising an outer exposed continuous layer of embossed metallic aluminum foil and a sheet of a more springy material than the said aluminum foil attached to the said aluminum layer in such manner as to form an integral part of every fold of the said wrapping material and adapted, in conjunction with the said aluminum foil, to have sufficient resilience and strength to permit of its being handled in conventional packing machinery.

4. An explosive assembly as recited in claim 3, wherein the said sheet of a more springy material consists of paper.

5. A blasting explosive material having a liquid ingredient, and a wrapping material for the same, comprising at least one layer of a laminated material, consisting of at least one continuous layer of embossed aluminum attached to a layer of flexible and more springy material, the said laminated material being of such nature as to be capable of forming a conventional type of blasting explosive shell of sufficient resiliency to permit its being loaded with blasting explosives by a conventional means.

6. An explosive assembly as recited in claim 3, wherein the said layer of aluminum foil, and the said sheet of a more springy material are attached to each other with the aid of at least one of the group of binding materials, consisting of wax, lacquer, glue, shellac, varnish, tar, asphalt, gum, resin, latex, and silicate.

7. A blasting explosive assembly as recited in claim 5, wherein the said aluminum layer, and the said layer of flexible and more springy material are uniformly attached to each other with the aid of at least one of the group of binding materials, consisting of wax, lacquer, glue, shellac, varnish, tar, asphalt, gum, resin, latex, and silicate.

8. A dynamite stick assembly, comprising a body of dynamite and a shell wrapper for the same, comprising an outer sheet of embossed aluminum foil, and an inner sheet of springy paper, said sheets lying in such close engagement with each other that the springiness of the paper is imparted to the foil sheet to hold the latter distended and in shape during the packing of the dynamite in the container.

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