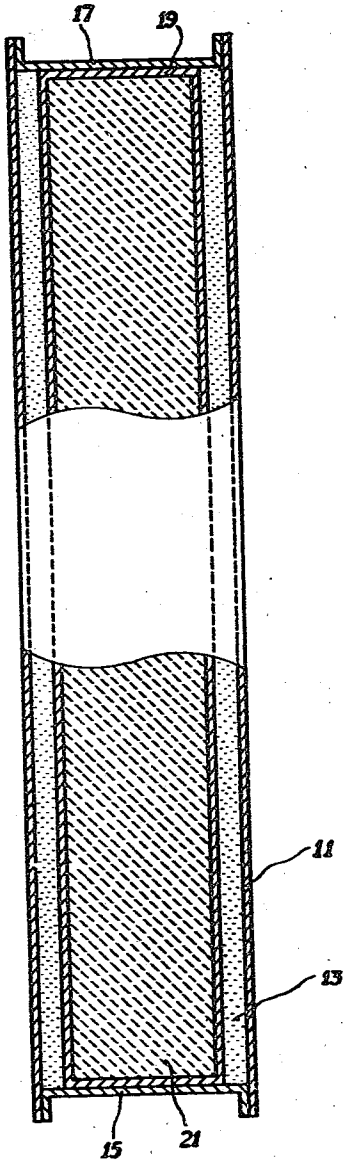
Dec. 31, 1946. C. D. PRATT ET AL 2,413,516

SHEATHING MATERIAL

Filed April 20, 1944



CARL D. PRATT

JAMES A. FARR

INVENTORS

BY Kenneth C. Mumford

ATTORNEY

Patented Dec. 31, 1946 2,413,516

UNITED STATES PATENT OFFICE

2,413,516

SHEATHING MATERIAL

Carl D. Pratt and James A. Farr, Tamaqua, Pa., assignors to Atlas Powder Company, Wilmington, Del., a corporation of Delaware

Application April 20, 1944, Serial No. 531,888

10 Claims. (Cl. 102—24)

1

The present application relates to sheathing for explosives.

An object of the invention is the provision of an improved sheath for an explosive cartridge.

Another object of the invention is the provision of an improved sheathing composition for an explosive cartridge.

A further object of the invention is the provision of an improved sheathed explosive.

Still another object of the invention is the provision of a sheath for an explosive cartridge, which sheath has improved volume and weight characteristics.

A still further object of the invention is the provision of a sheath for an explosive cartridge, which sheath is sturdy and yet can be cut easily.

Other objects will become apparent from the following description.

Most explosives, when fired, produce a hot flame. In gaseous and dusty locations, this flame is a source of danger; for it may initiate an explosion in the surrounding atmosphere.

It has been known for some time that this danger may be reduced if explosive cartridges are sheathed in compositions containing flame suppressing chemicals. The flame suppressing chemicals employed operate, it is believed, to reduce the flame temperature or to prevent the flame from reaching mine dust or gases. Probably both of these effects occur.

Many materials which decompose with the absorption of heat or which have high specific heats have been used as flame suppressing chemicals in sheathing materials. Such materials as hydrated salts such as hydrated magnesium sulphate, borax, and gypsum, iron filings, alkali halides, such as sodium fluoride, sodium chloride, and potassium chloride, magnesium carbonate, and sodium bicarbonate have been employed.

Explosive cartridges of different sizes and compositions usually require different weights of sheathing composition and often these weights should be within rather narrow limits, if optimum effects are to be obtained. If the sheaths are too heavy, the explosive efficiency is unduly lowered while if they are too light there is insufficient flame suppression. For best results, however, sheaths should be made co-extensive in length with the sheathed cartridges and usually it is preferred to avoid a wide variety of sheath wall thicknesses both from a point of view of ease of manufacture and from a consideration of convenience of use. Sheath walls about ⅛" or about ¼" and therebetween in thickness have usually been found most desirable.

2

Since the sheath dimensions are not readily varied, sheath weight is most effectively altered by means of change in sheath density. Many sheathing compositions heretofore proposed have not been susceptible for preparation of sheaths of sufficiently varying densities.

The sheaths prepared according to the present invention are characterized by extraordinary flexibility of density control.

Usually it is desired that sheaths be prepared as self-sustaining units which will hold their shape before they are placed around explosive cartridges. It is then important that the sheaths be sufficiently strong and rigid to withstand rough handling. At the same time, it is desirable that the sheaths be readily susceptible to cutting without crumbling when part cartridges are to be used.

Many of the sheathing compositions prepared prior to the present invention have required the inclusion of undesirable bonding agents. Some have employed adhesive organic materials which are troublesome to use and which produce sticky compositions giving considerable difficulty in loading. Other bonding materials which have been necessary in prior compositions have caused the compositions to set up into brittle sheaths which cannot be readily cut; and, in some cases, such sheaths have been so hard that the force of the explosion, instead of disintegrating the sheaths into a powder so that the flame suppressing chemical may act, has merely broken them into large pieces which fly off uselessly. Sheaths bonded in other ways have permitted passage of a knife but have crumbled away on cutting.

Sheaths of the present invention when compressed, as by ordinary tamping, during formation may be made up without the inclusion of bonding agents and yet form entirely satisfactory sturdy sheaths. When sheaths of this invention are prepared with looser packing procedures, firm and strong sheaths which may be readily cut without crumbling may be prepared with the inclusion of inorganic binding agents such as are described hereinafter.

Some sheaths suggested prior to this invention have contained organic substances, as filler materials for example. Such substances being combustible have, to the extent of their presence, defeated the flame suppressing function of the sheaths. Sheaths of this invention may be prepared without the inclusion of organic materials.

When sheathing materials are loaded to form coherent sheaths they are usually mixed with water to permit proper sheath formation. The water is later dried out so that the sheaths may be sufficiently firm and strong. Many sheathing compositions have required so much water during formation that they have become objectionably wet and have had insufficient wet strength, while other compositions have, on loading, tended to ball up or to become lumpy and consequently have been difficult to pack.

The sheathing compositions of the present invention on the other hand take up water in sufficient quantities to provide cohesive self-sustaining sheaths of good wet strength without becoming difficult to load.

These sheathing materials of the present invention are prepared with combinations of a flame suppressing chemical and expanded perlite.

Expanded perlite, a commercially available material, is the mineral perlite, a volcanic glass composed largely of an alkali aluminum silicate, which has been put through a heating process so that it is expanded into an extremely light cellular form.

The invention will be described in connection with the drawing, which is a view, partly in section, of a sheathed explosive cartridge.

As shown in the drawing, 11 is a cylindrical paper shell inside which lies sheathing composition 13. The ends of shell 11 are closed by end wads 15 and 17. Lying inside sheathing 13 is an explosive cartridge made up of paper shell 19, inclosing explosive charge 21.

A sheathed explosive such as that shown in the drawing may be prepared by placing shell 11 over a solid mandrel which is about the size of the explosive cartridge to be sheathed. The sheathing composition is then packed between the shell and the mandrel. The mandrel is removed and the sheath is dried. Then the cartridge of explosive is inserted in the sheath and the end wads are fastened in place to produce the finished sheathed explosive.

Sheathing materials of the present invention are also particularly adapted for use in the preparation of preformed sheaths, such as are disclosed in the application of Daniel D. Huyett and Frank S. Pollock, Ser. No. 315,094, filed January 22, 1940 for "Sheathing for explosive."

The following examples illustrate specific embodiments of the invention.

Example 1

20% of fine expanded perlite, 99% of which passed a U. S. Standard No. 12 sieve, was mixed with 80% of pulverized sodium bicarbonate. The composition was then thoroughly mixed with an amount of water amounting to 10% of the dry ingredients. The mixture was loaded by tamping it into an 8 gram heavy paper shell 1¾" in diameter and 8½" long around a mandrel 1⅛" in diameter. The material loaded into the shell easily and had good wet strength, as was shown by the absence of crumbling on removal of the mandrel. After the mandrel was removed, the sheath was dried at 65° C. It was then firm and strong, could be easily cut, and weighed 108 grams.

Example 2

A sheath was prepared in accordance with the procedure of Example 1 except that it was composed of 25% fine perlite and 75% sodium bicarbonate. Loading was again easy and wet

strength was good. The dry sheath was firm and strong, readily cut, and weighed 100 grams.

Example 3

Another sheath was prepared as in Example 1 except that in this case a coarser grade of perlite, 90% of which passed a U. S. Standard No. 8 sieve and 98% was held on a U. S. Standard No. 45 sieve. This sheathing mixture also possessed good wet strength. It was slightly more difficult to load than the composition of Example 1, but not objectionably so. It produced a good firm sheath easily cut, weighing 105 grams on drying.

Example 4

A sheath was prepared having the proportions used in Example 2 and by the method of Example 2, but the coarser expanded perlite was used. The dried sheath weighed 101 grams and had properties slightly better than those of the sheath of Example 3.

It is found that sheaths may be strengthened if some binding agent such as Epsom salts (magnesium sulphate) is added to the mix.

The addition of some fibrous material improves the flexibility of the sheaths. Short fibered asbestos is particularly desirable for this purpose.

The next two examples show different formulations, using Epsom salts and short fibered asbestos, which have produced valuable sheaths. In each of these examples, the fine expanded perlite was used and the proportion of water given is based on the total weight of the other ingredients. In each case, the Epsom salts were dissolved in the water which was mixed with the remaining ingredients as in the examples above. The sheaths of each of the following examples, however, instead of being tamped, were packed by vibration packing. The mandrel was fixed in an upright position on a vibrating table. The paper shell was placed around the mandrel and the sheathing composition was poured in as the table vibrated. These sheaths all showed excellent wet strength and loading characteristics and all shells produced were found on drying to have good flexibility and to be firm, strong sheaths which were easily cut.

Example 5

	Per cent
Sodium bicarbonate	65
Epsom salts	10
Expanded perlite	20
Short fibered asbestos	5
Water	10

Dried sheaths prepared according to this formulation weighed 65 to 70 grams.

Example 6

	Per cent
Sodium bicarbonate	80
Epsom salts	10
Expanded perlite	5
Short fibered asbestos	5
Water	10

Dried sheaths prepared according to this formulation weighed 89 to 95 grams.

While all of the above examples relate to the use of sodium bicarbonate as a flame suppressing chemical, and it is usually preferred that this chemical be used, it being one of the most efficient and economically used flame suppressing chemicals, other flame suppressing chemicals, such as those listed hereinbefore, may also be employed in the present invention.

The following three examples show formulations using 70 mesh sodium chloride or powdered borax as flame suppressing chemicals. The sheaths of these examples were prepared in the same manner as that described for Examples 5 and 6 above. In each case the fine expanded perlite was used.

Example 7

	Per cent
Sodium chloride	75
Expanded perlite	20
Short fibered asbestos	5
Water	15

Sheaths prepared from this formulation loaded well, exhibited satisfactory wet strength and dried to form good firm sheaths having a weight range of from 71 to 72 grams.

Example 8

	Per cent
Sodium chloride	70
Epsom salts	10
Short fibered asbestos	5
Expanded perlite	15
Water	10

Sheaths prepared according to this formulation loaded easily, showed excellent wet strength and dried to form entirely satisfactory sheaths which were somewhat stronger than the sheaths of Example 7. These sheaths weighed 82 to 85 grams.

Example 9

	Per cent
Borax	80
Short fibered asbestos	5
Expanded perlite	15
Water	45

These sheaths were also entirely satisfactory as to loading and as to wet and dry characteristics. They weighed from 62 to 64 grams.

It will be readily seen that the present invention provides a sheathing material which affords great flexibility in sheath density since sheath density may be varied with the amount of expanded perlite included, this amount being subject to wide variation for use in different situations. It is found that as little as 2% and as much as 65% by weight of the dry ingredients of sheaths of this invention may be made up of

expanded perlite and yet the advantages of the present sheathing compositions will be retained.

The Epsom salts binding agent appears to crystallize in an interlacing needle formation which assists in making the sheaths cohesive. Other similar materials such as plaster of Paris may also be used as binding agents. These materials being hydrated salts have the additional value of being flame suppressing chemicals themselves.

Sheaths of the present invention may be packed in any convenient manner. In addition to the tamping and vibration packing examples given above, extrusion and pelleting procedures may, for example, be employed.

Other fibrous materials than short fibered asbestos may be used to provide increased flexibility in the sheaths of the present invention. For example, wood pulp may be used for this purpose. Also sheaths of the present invention may include any of the numerous binder and filler ingredients in the art.

What is claimed is:

1. A sheathing composition for explosive cartridges comprising a flame suppressing chemical and expanded perlite.

2. A sheathing composition for explosive cartridges comprising a flame suppressing chemical, expanded perlite, and a binding material.

3. A sheathing composition for explosive cartridges comprising sodium bicarbonate and expanded perlite.

4. A sheathing composition for explosive cartridges comprising sodium bicarbonate, expanded perlite, and magnesium sulphate.

5. A sheathing composition for explosive cartridges comprising sodium bicarbonate, expanded perlite, magnesium sulphate and asbestos fiber.

6. An explosive cartridge sheathed with a composition according to claim 1.

7. An explosive cartridge sheathed with a composition according to claim 2.

8. An explosive cartridge sheathed with a composition according to claim 3.

9. An explosive cartridge sheathed with a composition according to claim 4.

10. An explosive cartridge sheathed with a composition according to claim 5.

CARL D. PRATT.
JAMES A. FARR.