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EXPLOSIVE

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This invention relates to new and improved explosives of the dynamite type.

In its simplest form dynamite consists of a sensitive liquid explosive compound such as nitroglycerine and an absorbent non-explosive carrier material of which sawdust, kieselguhr, wood pulp, balsa wood, corn meal and certain inorganic salts such as calcium carbonate are well known examples. At the present time, dynamites are produced in various compositions adapted for various purposes and conditions of use. There are, for example, the "straight" dynamites, the gelatin dynamites embodying a solution of liquid explosive compound such as nitroglycerine in nitro cellulose, as well as the so-called "permissible" explosives which are compounded so as to possess a relatively low flame temperature and are adapted especially for use in the mining of coal and the like. These and other types of dynamites generally include as ingredients a liquid explosive material, sometimes referred to as a "sensitizer", such as nitroglycerine, liquid nitric ester, for example, ethylene glycol dinitrate, nitro glycol and nitro polyglycerine and an absorbent material, or filler, of the character represented by the examples above named. In place of part of the liquid explosive component, an explosive salt, such as ammonium nitrate, is often used, and the composition also generally includes an oxygen-carrying substance such as sodium nitrate. This invention relates to these dynamite compositions in general, and it has particular reference to the provision of an improved filler therefor and of improved dynamite compositions embodying such a filler.

An object of the invention is to provide an improved explosive composition embodying an explosive compound and an improved filler of cellular structure which increases the effectiveness of the composition by incorporating therein a substantial amount of air.

Another object of the invention is to provide explosive compositions of very low density without destroying their explosive power and sensitivity to detonation.

Another object is to provide an improved filler for dynamite which possesses a very low apparent density and a cellular structure encompassing considerable quantities of air.

Still another object is to provide a filler which is of sufficient rigidity to retain its shape and to keep the density of the dynamite composition in which it is used permanently low despite compressive forces encountered in handling and locating for use.

A further object is to provide a filler having an extremely low apparent density and favorable absorption qualities for explosive purposes.

I have found that valuable dynamite compositions may be obtained by including in such compositions a filler comprising alkali metal silicate bubbles. As a product of manufacture alkali metal silicate bubbles and a suitable method for preparing them have been known in other arts prior to my invention.

It has not been known, however, that they possess desirable qualities which make it advantageous to employ them in the production of explosive compositions and fillers for explosives.

The improved filler material of my invention may be prepared by forming particles of incompletely dehydrated sodium or potassium silicate and subjecting these particles to rapid heating to temperatures above 300° C., and preferably to between 350° and 550° C., in order quickly to drive off the remaining water and to form distinct cellular pellets, or bubbles, while simultaneously agitating to prevent coherence of the bubbles or adherence to the heating apparatus.

In greater detail, a suitable method for producing the filler is to flow liquid sodium silicate, or water glass, into a drying apparatus where it is subjected to temperatures not greater than 100° C. and dried until approximately 70% of the water has been removed. From the drier, depending upon the type of apparatus employed, lumps, sheets or finely divided particles of partially dehydrated sodium silicate are obtained. If in the form of lumps or sheets, this material is pulverized and then passed through screening apparatus in order to exclude particles of undesirable size. The selected particles, preferably of between 40 and 60 mesh, are then passed into an externally heated kiln where they are suddenly heated to temperatures of the order of 400° C., while being agitated by revolution of the kiln. This sudden heating of the particles drives off water and explodes the particles into the form of distinct fluffy cellular pellets, or bubbles. These bubbles contain large quantities of air, and they may be made of sufficient strength to resist compressive forces encountered in use as a constituent of dynamite. Their absorbent qualities are favorable, and their apparent density, as determined by weighing a given volume of the material, is considerably less than .1 gram per c. c.

In the preparation of explosive compositions in accordance with my invention, the filler of the compositions heretofore known and used may

be displaced partly or entirely by alkali metal silicate bubbles. More than 1% and usually not more than 35%, by weight, of the improved filler will generally be used.

- 5 An illustrative example of the improved explosive compositions, having a very high cartridge count, is as follows:

	Per cent by weight
Nitroglycerine	12
10 Ammonium nitrate	61
Sodium nitrate	15
Sodium silicate bubbles (apparent density .06)	12

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The compositions may be prepared by any of the procedures known to the art. A suitable procedure is to mix the bubbles with the explosive and oxidizing salts and then with the liquid "sensitizing" compound, of course with the usual precautions.

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The improved filler is well adapted for use in explosive compounds which are improved by the presence of substantial quantities of air. It is particularly advantageous for the production of permissible explosives, because of the relatively small amount of liquid explosive compound, for example, nitroglycerine, which is absorbed by a given volume of the filler and because of its extremely low apparent density, which enables the sensitive explosive compound to be extended throughout a greater volume and thus lowers the shattering effect of the explosive without destroying its sensitiveness to detonation. The improved filler is also advantageous in that it is relatively non-deliquescent after exposure for a short time to temperatures of the order of 400° C. or higher, and because of its alkaline quality, caused by the presence of a small percentage of free Na_2O or K_2O , which improves its capacity to stabilize highly sensitive explosive compounds.

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The alkali metal silicate bubbles may be produced in various particle sizes and with varying compressive strength and porosity by simple variations of the process of manufacture. They may therefore be easily adapted for different conditions of use. Their apparent density is well below .1 gram per c. c. and usually of the order of .05 gram per c. c., but satisfactory bubbles may be prepared with an apparent density as low as from .01 to .03 gram per c. c.

Certain physical qualities of the improved filler as compared with other well known filler materials are indicated by the following table showing

results of comparative tests for apparent density and absorption properties.

	Apparent density (grams per c. c.)	Parts glycerine absorbed by 100 parts of filler, by weight	Volume glycerine absorbed by 100 c. c. of filler
Bubbles No. 1	.05	426.8	16
Bubbles No. 2	.0575	564	25.6
Sawdust	.23	405.4	74.1
Paper pulp	.18	746.9	118

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The much lower apparent density of the bubbles and their improved absorption characteristics for explosive purposes as indicated by these tests are reflected in explosive compositions embodying the new filler. Thus dynamites including a relatively small proportion of a sensitizing ingredient extended over a large volume of composition may be prepared, and these dynamites still retain their ability to explode properly as well as other favorable characteristics induced by the special qualities of the filler.

The improved explosives may be compounded with any suitable ingredients and in any proportions without departing from my invention, which should be accorded a scope commensurate with the spirit of the specification and the requirements of the claims.

I claim:

1. An explosive composition including dynamite comprising an explosive compound and a filler of alkali metal silicate bubbles.

2. An explosive composition comprising nitroglycerine in admixture with sodium silicate bubbles.

3. An explosive composition including dynamite comprising a liquid explosive compound and an absorbent filler of distinct cellular bubbles of alkali metal silicate.

4. An explosive composition including dynamite comprising a liquid explosive compound and a filler of substantially anhydrous alkali metal silicate having an apparent density considerably less than .1 gram per c. c.

5. An explosive composition including dynamite comprising sodium silicate bubbles having an apparent density of the order of .05 gram per c. c.

6. An explosive composition comprising dynamite having a filler of sodium silicate bubbles.

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