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FIRE FIGHTING COMPOSITIONS

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This invention relates to improvements in fire fighting compositions. In one specific aspect it relates to the use of rolled vermiculite in fire fighting compositions.

To be of practical value a fire fighting composition must

- (1) Be capable of getting at the point of combustion;
- (2) Cool the burning site below the ignition temperature;
- (3) Exclude oxygen if possible;
- (4) Adhere or remain in the vicinity of the point of combustion;
- (5) Be economical and easily transportable.

Water having many of these attributes is the most universally used fire fighting agent. However liquid water is often ineffective because it tends to flow away from the point where it can be of use.

Many chemicals and combinations of materials have been employed to increase the effectiveness of water in controlling fire. These include various viscosity-increasing agents, such as clays, gel formers and various gas forming agents, such as sodium bicarbonate.

However, these prior art materials have not been completely satisfactory. Viscosity controlling materials such as carboxy methyl cellulose and align resist hydration. The clays are slow water imbibes and are abrasive to pumping equipment. The gas formers react readily unless the components are segregated.

It is therefore an object of this invention to provide fire fighting compositions which overcome these prior art objections; that are light weight and easily transportable, can be projected at and adhere to combusting surfaces, and are economical to use.

These and other objects will become apparent in the following detail description and examples.

Broadly I have found that these and other objects of the invention can be accomplished by the incorporation of rolled vermiculite into fire fighting compositions.

Vermiculite is a micaceous material that exfoliates upon heating to a low density adsorbent material. Rolled vermiculite is recompacked granular exfoliated vermiculite. The exfoliated vermiculite is fed onto rolls which are rolling in opposite directions so as to squeeze the vermiculite between the rolls. The compacted product comes out as a continuous sheet which can be readily granulated. This rolled vermiculite is self-bonding. The intermolecular attraction of fresh surfaces of vermiculite exposed when the particles are crushed between the rolls, and put into intimate contact under pressure, are responsible for the bond. When the rolled vermiculite granules are immersed in water the bonding forces are broken, by the stronger affinity between the rolled vermiculite and the water. The granules swell to within 70% of the original volume and the water is absorbed in the pores previously filled with air. The rolled vermiculite used in the practice of this invention is in the granular form.

The three most important kinds of fire fighting compositions in which rolled vermiculite is effective are:

- (1) Dry powder extinguishing agents, wherein a powder is directed at the base of the flame through a nozzle by gas pressure.
- (2) The dry powder extinguishing agents used in combination with water and applied in forms of slurries such as by hose or air drop method.
- (3) Foaming compositions, which involve a reactive dry powder

composition which on contact with water foams to produce a fire extinguishing agent.

In the first type of dry powder extinguishing agents rolled vermiculite is unusually effective because of its particulate nature. The micaceous platelets have the property of being thin in one dimension and each particle therefore covers a relatively large area per unit mass. These platelets of vermiculite tend to adhere to a combusting surface. Dry rolled vermiculite also provides anti-caking properties when used in conjunction with other dry powder extinguishing agents.

Roller vermiculite is particularly advantageous in preparing compositions of reactive materials. Each of several components of a composition can be blended with expanded vermiculite prior to recompacking vermiculite, so that a micropacking effect is obtained. Thus, otherwise reactive materials can be handled as mixtures. As an example aluminum sulfate can be encapsulated in rolled vermiculite reducing the opportunity for reaction with a co-mingled quantity of sodium bicarbonate. When the mix is contacted with water, re-exfoliation occurs and reaction between the aluminum sulphate and sodium bicarbonate can progress to produce the desired foaming action.

Reactive materials which can be encapsulated in rolled vermiculite fire fighting composition are dry acidic materials and CO₂ forming salts. The dry acidic materials include organic acids such as citric, tartaric, oxalic, fumaric, itaconic, etc. or any acid salt such as the sulphates, chlorides, and nitrates of aluminum, magnesium, cobalt, zinc, nickel etc. The CO₂ forming salt include sodium bicarbonate, sodium carbonate, potassium carbonate etc.

The concentration of these materials depends upon the degree of foaming desired. Where it is necessary that foaming be effective for an extended period of time, large amounts on the order of 40 parts by weight of each of the active ingredients may be required, where for reasons of economy and where the fire to be extinguished is relatively small in area lower quantities on the order of 10 parts by weight of each of the active ingredients can be tolerated. The quantity of rolled vermiculite used with these active ingredients is on the order of from about 20 to 80 parts by weight.

Roller vermiculite contributes other desirable qualities to foaming fire fighting compositions. These inorganic platelets contribute thermal stability to the foam and as the foam collapses, they provide a fire resistant coating over an otherwise combustible surface. The dispersed rolled vermiculite platelets also enhance the tendency of the foamed mass to adhere to surfaces. This feature is particularly advantageous when combating fire where gravity is important and the combustion is occurring on non-horizontal surfaces or structures.

When rolled vermiculite is included in any composition to be used as a slurry or solution, it substantially reduces the time and work requirements to obtain a useable composition. It is also within the scope of this invention, to use rolled vermiculite fire fighting compositions in home and industrial fire fighting equipment such as dry charge fire extinguishers and the like.

The present invention will be further illustrated but not limited by the following examples.

Example 1

A composition consisting of:

	Parts by weight
Aluminum sulphate	40
Sodium bicarbonate	40
Licorice	5
Zinc stearate	5
Roller vermiculite	10

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was prepared as follows: The 40 parts aluminum sulfate were first combined with the 10 parts vermiculite, said vermiculite being in the exfoliated form. After thoroughly mixing the aluminum sulfate and exfoliated vermiculite, the mass was compressed to small volume so as to envelope the aluminum sulfate particles in the rolled vermiculite. The 40 parts pulverant sodium bicarbonate were thoroughly blended with the 5 parts powdered zinc stearate and 5 parts licorice to obtain a uniform mixture. Then the aluminum sulfate-rolled vermiculite mixture was co-mingled with the sodium bicarbonate-zinc stearate-licorice portion and the whole quartered several times, passed through an 8-mesh screen, and stored in a tight container to exclude moisture from the mix.

In use, the composition of this example is contacted with water in a ratio of approximately 1 lb. of the mix per gallon of water. A fluid, foaming mass is obtained that can be delivered to the point of combustion for extinguishing the fire by a blanketing and cooling action.

Example II

A composition consisting of:

	Parts by weight
Diammonium phosphate -----	20
Rolled vermiculite -----	30
Ammonium sulfate -----	49.5
Carboxy methyl cellulose -----	0.5

was prepared as follows. 30 parts exfoliated vermiculite were thoroughly co-mingled with the 49.5 parts ammonium sulphate and 20 parts diammonium phosphate, and the resulting mass compressed to small volume so as to obtain the rolled vermiculite form. These particles were then passed through a 6-mesh screen and blended with the 0.5 part pulverant, medium viscosity, carboxy methyl cellulose.

In use, the foregoing composition is admixed with water to obtain the desired mass consistency to suit the particular need. If a composition is to be air-dropped for forest fire control, sufficient water is employed to obtain a plastic, adherent mass. This composition has the high degree of mass coherence necessary for dropping through turbulent air encountered in forest fire management. This same composition can be used in conjunction with relatively large amounts of water to obtain a more fluid slurry that can be directed to the base of the flame by hose application. In the dry state, this powdered mix flows readily through a powder injector to a water hose system. The rolled vermiculite contributes greatly to the free flowing quality of the composition.

Example III

Compositions consisting of:

Compounds	Parts by weight		
	#1	#2	#3
Rolled vermiculite -----	29.5	56	67
Diammonium phosphate -----	70	40	30
Algin (pH insensitive) -----	0.5	4	3
Sodium silico fluoride ¹ -----		0.04	0.03

¹ Corrosion inhibitor.

were prepared as follows: the pulverant diammonium phosphate was co-mingled with expanded vermiculite and then followed by compaction to obtain the rolled vermiculite characteristics. The mass is then passed through a 6-mesh screen and thoroughly co-mingled with the 0.5 part of powdered algin and sodium silico fluoride by tumbling. The compositions are free-flowing powders requiring no special storage precautions. At the point of use, the powder is mixed with water with mild agitation

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to obtain a slurry of the desired consistency. The rolled vermiculite, in conjunction with the hydrated algin serves to disperse the diammonium phosphate in a fluid matrix of exfoliated vermiculite. The compositions of this example are effective on brush and grass fires, and adhere to the combustible material and prevent re-ignition.

In contrast to the borates which are sometimes employed for fire control, the compositions of this example will have no detrimental action on vegetative growth. Conversely, the diammonium phosphate has value as a fertilizer material.

Rolled vermiculite is particularly advantageous when used in slurry compositions. It imbibes water much more rapidly than clays, such as the bentonites (frequently employed in fire fighting composition), and swells to form a hydrous mass. Rolled vermiculite slurry compositions adhere to surfaces with unusual tenacity. The platelets of rolled vermiculite tend to lie flat against plane surfaces thereby affecting optimum coverage. The rolled vermiculite also has a high degree of lubricity which facilitates pumping and reduces equipment maintenance required by the more abrasive clays.

Suspension and solution of components are assisted by the rapid water imbibing characteristics of rolled vermiculite. It is an ideal adjunct for use with secondary viscosity controlling materials such as carboxy methyl cellulose or the algin. When large amounts of carboxy methyl cellulose or algin are contacted with liquid water, they resist hydration and usually require mechanical means for dispersion. In contrast to this, if a given quantity of carboxy methyl cellulose or algin is distributed over the surface of a rolled vermiculite, bulk hydration of the carboxy methyl cellulose is promptly obtained.

The following example shows compositions of rolled vermiculite and algin. The preferred algin is pH insensitive.

Example IV

Compositions consisting of:

Compounds	Parts by weight	
	#1	#2
Rolled vermiculite -----	95	99
Algin (pH insensitive) -----	5	1

were prepared by co-mingling the algin with the rolled vermiculite. When contacted with water the algin provides a high viscosity medium for carrying the water imbibing, rolled vermiculite. In use these compositions provide low cost, gelatinous, adhesive masses which can be air dropped upon remote fires.

What is claimed is:

1. A fire fighting composition which consists of a mixture of;

- (1) 80 to 20 parts by weight of rolled vermiculite,
- (2) 10 to 40 parts by weight of a CO₂ forming salt selected from the group consisting of sodium bicarbonate, sodium carbonate and potassium carbonate;
- (3) 10 to 40 parts by weight of a dry organic acid selected from the group consisting of citric acid, tartaric acid, oxalic acid, fumaric acid and itaconic acid.

2. A fire fighting composition which consists of a mixture of;

- (1) 80 to 20 parts by weight of rolled vermiculite;
- (2) 10 to 40 parts by weight of a CO₂ forming salt selected from the group consisting of sodium bicarbonate, sodium carbonate and potassium carbonate;
- (3) 10-40 parts by weight of dry inorganic acid salts

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selected from the group consisting of sulfates, chlorides, nitrates of aluminum, magnesium, zinc and cobalt.

3. The composition of claim 2 wherein the CO₂ forming salt is sodium bicarbonate and the dry inorganic acid salt is aluminum sulfate. 5

4. A fire fighting composition which consists of a mixture of:

- (1) 29.5-67 parts by weight of rolled vermiculite
- (2) 30-70 parts by weight of diammonium phosphate 10
- (3) 0.5-3 parts by weight of algin
- (4) 0.3-0.04 parts by weight sodium silico fluoride.

5. A fire fighting composition which consists of from about 95 to 99 parts by weight of rolled vermiculite and from about 1 to 5 parts by weight of algin.

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