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DRY FIRE EXTINGUISHING COMPOSITION

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The present invention relates to an improved dry fire extinguishing composition in free flowing powdered form and in particular relates to powdered dry chemical fire extinguishing compositions of the type disclosed in co-pending application Serial No. 596,169, filed July 6, 1956.

The fire extinguishing compositions in such co-pending application are based upon a combination of foam forming substances, such as phosphoric acid and/or boric acid or their salts or addition products, and condensation products of aldehydes with reactive amino compounds, that is, those containing at least one —NH_2 , preferably urea or its derivatives, such as urea, thiourea, guanidine, dicyandiamide and melamine. Preferably, the aldehyde component of the condensation product is formaldehyde or acrolein or mixtures thereof.

Normally, in addition to the indicated basic foam forming and condensation product components, it is desirable that the compositions also contain materials which increase the carbon content of the foam formed when the compositions are employed to extinguish fires. The materials which have been suggested for increasing such carbon content of the foam have been carbohydrates, such as starch, sugar, dextrin and cellulosic compounds, or proteinaceous materials, such as casein, glue, gelatine and other glue like proteins. Generally, the quantity of such carbohydrates or proteinaceous material should not exceed .7 part per part of foam forming phosphoric acid or boric acid component.

Also, such fire extinguishing compositions can, in addition to the components indicated, contain inorganic crust forming materials in finely divided form, such as asbestos flour, Kieselguhr, gypsum, barite, slate meal and the like. Furthermore, they also can contain other substances used in dry chemical fire extinguishers, such as sodium bicarbonate.

The dry powdered fire extinguishing composition of the type indicated can be applied to burning materials by any conventional methods, for example, with standard dry chemical fire extinguishers in which the compositions are blown with the aid of carbon dioxide under pressure. Upon application to burning materials they melt under influence of the heat of the fire and adhere even to vertical surfaces to form an adherent porous carbon containing solid foam which smothers the fire and provides excellent heat insulation. At the same time incombustible gases are developed which prevent spread of the fire.

In some instances, however, it was found that the dry fire extinguishing compositions of the type described have only a limited storage life and that especially when large temperature fluctuations are encountered the powdered components have a tendency to agglomerate and thereby lose their free flowing characteristics which are desired for ease of application. Evidently the hygroscopicity of some of the components employed, and especially starch, is to some extent the cause of such agglomeration.

According to the invention it was unexpectedly found that dried powdered sulfite waste liquor is not only admi-

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rably suited as a carbon forming component and therefore can replace all or a part of the carbohydrates or proteinaceous materials previously employed as carbon forming components, but also reduces the tendency of the fire extinguishing compositions to agglomerate. For example, when employed to replace the starch customarily employed, no agglomeration of the fire extinguishing composition occurred, even after repeated temperature fluctuations between $+80^\circ$ and -20° C. Preferably, the quantity of dry powdered sulfite waste liquor employed is between 30 and 70 parts by weight per 100 parts by weight of the boric acid and/or phosphoric acid foam forming component.

The free flow characteristics of the fire extinguishing compositions according to the invention can be still further improved by the addition of known free flow improving agents or agents which render the composition hydrophobic. Suitable materials for this purpose are finely divided materials which physically prevent agglomeration of the powdery composition, for example, finely divided silicon dioxide obtained as an aerogel by vapor phase decomposition of volatile silicon compounds, for example, by hydrolysis of silicon tetrachloride in the vapor phase at temperatures of about 600° C. and above, carbon black, talcum powder or lycopodium, and materials which render the surface of the powdery materials hydrophobic, for example, water insoluble salts of the higher saturated or unsaturated fatty acids, such as magnesium, aluminum or zinc stearates or oleates, or the free higher fatty acids, their esters, waxes or other water repellent higher hydrocarbons, and silicones. The materials serving to prevent agglomeration of the dry finely divided fire extinguishing compositions are expediently incorporated in such compositions either during or after the fire extinguishing compounds are ground to finely divided form. The finely divided materials, such as silicon dioxide and the like, are preferably incorporated when the fire extinguishing components are ground. The water repellent materials can be easily incorporated in the powdery fire extinguishing compositions in the form of a dispersion or solution in volatile non-aqueous solvents. Upon drying of such mixtures, water repellent films are formed upon the individual particles of the fire extinguishing compositions. The water repellent materials can also be formed in situ on the fire extinguishing composition itself, for example, by treating the composition first with an aluminum salt and then with a fatty acid. Water repellent materials can also be applied to the fire extinguishing compositions as gases, for example, the fire extinguishing compositions can be rendered water repellent by treatment with a vapor of a silicone.

The solid aldehyde condensation products which form an essential ingredient of the fire extinguishing compositions according to the invention are described in many publications, for example, in U.S. Patent No. 2,452,054, in German Patents Nos. 730,357, 802,846, 803,854, 833,707, 897,408 and in French Patents Nos. 748,854, 799,269, 43,211 and 49,184.

The preferred condensation products are urea formaldehyde resins in which the molar ratio of urea to formaldehyde is 1:1–2.5 and urea-formaldehyde-acrolein resins in which the molar ratio of urea to formaldehyde to acrolein is 1:20–2.5:0.12–0.4 and preferably the molar ratio of urea to total aldehyde does not exceed about 2.6.

Preferably the quantity of foam forming phosphoric acid and/or boric acid compounds in the fire extinguishing compositions is about 1 to 6 parts per part of aldehyde condensation product.

The dry powdered fire extinguishing compositions according to the invention have not only been found admirably suited for extinguishing class B and C fires, but have also been found suited for deep seated class A fires

and in the latter instance their fire extinguishing action even exceeds that of soda-acid fire extinguishers which are approved for class A fires. Furthermore, the dry powdered fire extinguishing compositions according to the invention can also be used for special types of fires not coming within classes A, B and C fires, such as, for example, magnesium fires and rubber fires.

The following examples will serve to illustrate several embodiments of fire extinguishing compounds according to the invention:

Example 1

A mixture of the following composition was prepared:

	Kg.
Monoammonium phosphate -----	455
Tricalcium phosphate -----	10
Urea formaldehyde resin -----	87
Heavy spar meal -----	160
Dried sulfite waste liquor -----	223
Boric acid -----	15
Milori blue (pigment) -----	50

This mixture was thoroughly ground until it passed through a sieve having 1600 meshes per cm.² and then placed in standard 30 pound chemical fire extinguishers.

Example 2

A mixture of the following composition was prepared:

	Kg.
Monoammonium phosphate -----	455
Tricalcium phosphate -----	15
Urea formaldehyde resin -----	90
Heavy spar meal -----	163
Dried sulfite waste liquor -----	220
Finely divided silica -----	30
Milori blue (pigment) -----	27

This mixture was thoroughly ground until it passed through a sieve having 1600 meshes per cm.² and then was placed in standard 30 pound chemical fire extinguishers.

The urea formaldehyde resin employed in the examples was prepared as follows:

85 kg. of disodium phosphate were dissolved in 800 kg. of 30% aqueous formaldehyde and sufficient concentrated sodium hydroxide added (about ½ kg.) to adjust the pH of the solution to 8.2. Thereupon, the solution was stirred while adding 242 kg. of urea. At the beginning, the temperature of the solution dropped, but upon initiation of the condensation it began to rise and water cooling was employed to maintain a reaction temperature not above 35° C. Stirring was continued for three hours, at the end of which the reaction mixture was in the form of a relatively thick white paste containing the precondensate. Stirring was then ceased and the mass permitted to stand overnight. During such standing, the mass became relatively solid and it was heated for about a half an hour with steam to liquify the mass sufficiently to permit operation of the stirring mechanism. As soon as the stirring mechanism operated properly, the vessel containing the mass was closed and the mass heated while stirring to a temperature of about 50 to 60° C. under vacuum of between 0.8 and 0.95 atmospheres for 8 to 9 hours to evaporate the excess water contained in the mass. Thereupon, the heated mass which had become

viscid was passed into shallow pans and these were placed in a vacuum drying cupboard and allowed to remain therein for 24 hours to dry the resin further. When the resin was sufficiently dry it became very brittle and was easily removed from the pans and ground.

The fire extinguishing compositions of the examples were effective when applied to burning combustible materials in fires of classes A, B and C types. Classes A, B and C type fires are defined as follows by Underwriters' Laboratories Inc. of Chicago, Illinois:

Class A.—Fires of materials such as paper, wood, textiles, rubbish and the like.

Class B.—Fires of rapidly burning materials such as gasoline, oil or greases.

Class C.—Fires which are electrical equipment fires.

I claim:

1. A solid dry chemical fire extinguishing composition in the form of a finely divided mixture comprising a finely divided solid condensation product of an aldehyde and an amino compound capable of condensing with an aldehyde, at least one finely divided foam forming material selected from the group consisting of phosphoric acid salts, boric acid, and boric acid salts, and finely divided dried sulfite waste liquor the proportion of the condensation product to said foam forming material being between 1:1 and 1:6 and the proportion of foam forming material to dried sulfite waste liquor being between 100:30 and 100:70.

2. A fire extinguishing composition according to claim 1 in which said condensation product is a urea formaldehyde condensation product.

3. A fire extinguishing composition according to claim 1 in which the individual grains of such mixture carry a water repellent coating selected from the group consisting of water insoluble salts of higher fatty acids, higher fatty acid esters, higher fatty acids, waxes and silicones.

4. A fire extinguishing composition according to claim 1 which also contains a relatively small quantity of a finely divided solid which promotes the free flowing character of such mixture selected from the group consisting of finely divided silica, carbon black, talcum powder and lycopodium.

5. A method of combatting fires of burning combustible materials which comprises applying to said burning combustible material a solid dry chemical fire extinguishing composition in the form of a finely divided mixture comprising a finely divided solid condensation product of an aldehyde and an amino compound capable of condensing with an aldehyde, at least one finely divided foam forming material selected from the group consisting of phosphoric acid salts, boric acid, and boric acid salts, and finely divided dried sulfite waste liquor, the proportion of the condensation product to said foam forming material being between 1:1 and 1:6 and the proportion of foam forming material to dried sulfite waste liquor being between 100:30 and 100:70.

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