(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
25 September 2014 (25.09.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/152528 A1

(51) International Patent Classification:
A62D 1/00 (2006.01)

(21) International Application Number:
PCT/US2014/027441

(22) International Filing Date:
14 March 2014 (14.03.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/788,710 15 March 2013 (15.03.2013) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

WO 2014/152528 A1

(54) Title: FIRE EXTINGUISHING COMPOSITION

(57) Abstract: The present invention provides a fire extinguishing composition. The composition comprises monoammonium phosphate and potassium chloride. In one embodiment, the composition comprises a weight percentage of monoammonium phosphate in a range of between about 51 % and about 99%, and a weight percentage of potassium chloride in a range of between about 1 % and about 49%.

FIRE EXTINGUISHING COMPOSITION

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 61/788,710 filed March 15, 2013, the entire contents of which are hereby incorporated by reference.

TECHNICAL FIELD

[0002] This invention is directed to fire extinguishing compositions. More particularly, this invention provides fire extinguishing compositions comprising monoammonium phosphate and potassium chloride.

BACKGROUND

[0003] Fire extinguishing agents are often characterized in terms of the type of fire they are used to extinguish. For example, in the United States, Class A fires are characterized as ordinary solid combustibles; Class B fires are characterized as flammable liquids and gasses; and Class C fires are characterized as originating from electrical current. Not all fire extinguishing agents are suitable for all fire types. For example, liquid agents are not well suited for extinguishing fires of an electrical origin.

[0004] Dry powder fire extinguishing agents in commercial use are of two principal types. The first type is represented by sodium bicarbonate, potassium bicarbonate, ammonium borate, potassium borate, sodium borate (borax), sodium sulfate, sodium phosphate, sodium polyphosphate, sodium chloride, potassium chloride and the like. The agents of the first type are generally used on Class B and C fires. Among these agents, sodium bicarbonate and potassium bicarbonate are widely used. The performance of potassium chloride on Class B fires is inferior to that of potassium and sodium bicarbonate. Some research shows that potassium chloride works at reducing the size of a large fire. When the relative size and heat density of a fire is reduced, however, potassium chloride loses effectiveness, and the remaining small flames can reignite the fuel.

[0005] The second type of fire-extinguishing agents may be represented by monoammonium phosphate (MAP), ammonium polyphosphate and the like. MAP can be used on Class A, B, and C fires. Although MAP works well on Class A fires, it is a relatively expensive chemical. Further, MAP has poor to modest extinguishing characteristics for Class B fires.

SUMMARY

[0006] In one aspect, a fire extinguishing composition includes monoammonium phosphate and potassium chloride. In some embodiments, the weight percentage of monoammonium phosphate is in a range of between about 51% and about 99%, and the weight percentage of potassium chloride is in a range of between about 1% and about 49%. In some embodiments, the weight percentage of monoammonium phosphate is in a range of between about 65% and about 75%, and the weight percentage of potassium chloride is in a range of between about 25% and about 35%. In some embodiments, the composition also includes one or more additives selected from the group consisting of clay, poly(methylhydrogen)siloxane, water, silica, mica, ammonium sulfate, and combinations thereof. In some embodiments, the monoammonium phosphate and potassium chloride are in the form of powder. In some embodiments, the powder has an average particle diameter of from about 10 to about 100 μm. In some embodiments, the powder is siliconized.

[0007] In another aspect, a fire extinguishing composition consists essentially of monoammonium phosphate and potassium chloride. In some embodiments, the weight percentage of monoammonium phosphate is in a range of between about 51% and about 99%, and the weight percentage of potassium chloride is in a range of between about 1% and about 49%. In some embodiments, the total weight percentage of monoammonium phosphate and potassium chloride is more than about 90%.

[0008] In another aspect, a method of extinguishing a fire is disclosed. The method includes applying a composition to the fire, wherein the

composition having monoammonium phosphate and potassium chloride as further described herein.

[0009] In another aspect, a fire extinguisher is disclosed. The fire extinguisher has a composition of monoammonium phosphate and potassium chloride as further described here.

DETAILED DESCRIPTION OF THE INVENTION

[0010] This invention relates generally to fire extinguishing compositions comprising monoammonium phosphate (MAP) and potassium chloride.

[0011] MAP is a mild acid and the resulting chemical reaction when mixed with potassium and sodium bicarbonate reduces the effectiveness of the extinguishing material and may even render the extinguishing agent inert. Potassium chloride is neutral and can be mixed with MAP without chemical reaction. The cost of potassium chloride is typically lower than that of MAP.

[0012] The present disclosure provides a fire extinguishing composition comprising MAP and potassium chloride. The weight percentage of MAP in the composition can be in a range of between about 50% and about 99%. The weight percentage of potassium chloride in the composition can be in a range of between about 1% and about 49%. In some embodiments, the weight percentage of MAP is about 65%-75%, and the weight percentage of potassium chloride is about 25%-35%. In one embodiment, the composition comprises about 70% of weight percentage of MAP and about 25% of potassium chloride. In another embodiment, the weight percentage of MAP is about 70% and the weight percentage of potassium chloride is about 20%. In one embodiment, the total weight percentage of MAP and potassium chloride can be more than 90%.

[0013] In one embodiment, the composition consists essentially of MAP and potassium chloride. The weight percentage of MAP in the composition can be in a range of between about 50% and about 99%. The weight percentage of potassium chloride in the composition can be in a range of between about 1% and about 49%. In some embodiments, the weight percentage of MAP is about 65%-75%, and the weight percentage of

potassium chloride is about 25%-35%. In one embodiment, the composition comprises about 70% of weight percentage of MAP and about 25% of potassium chloride. In another embodiment, the weight percentage of MAP is about 70% and the weight percentage of potassium chloride is about 20%. In one embodiment, the total weight percentage of MAP and potassium chloride can be more than 90%.

[0014] The composition of the present disclosure can further comprise other additives, such as moist absorbers, flow agents, fillers, and pigments. These additives can be any suitable agents known in the art. For example, clay, poly(methylhydrogen)siloxane, water, silica, fumed silica, mica, ammonium sulfate, yellow pigments (complied with NFPA color requirements) and the combination of these additives can be used in the present composition without substantially changing the properties of the MAP and potassium chloride composition and the composition's effectiveness in extinguishing different classes of fires.

[0015] In one embodiment, MAP and potassium chloride are in the form of powders. In some embodiments, the particle size of the powder is in a range of between about 0.05 μm and about 300 μm. In some embodiments, the average particle size is between about 10 μm to about 100 μm.

[0016] MAP and potassium chloride powders can be obtained from many suitable processes. In one embodiment, MAP and potassium chloride are ground in a mill to obtain the powder of appropriate particle size. The powders are further siliconized in a powder blender. MAP and potassium chloride powders can be siliconized by any suitable siliconization processes. Then, siliconized powders can be mixed with other additives to provide the inventive compositions.

[0017] The present disclosure also provides a method to extinguish a fire, including Class A, B, and C fires. The method comprises applying the composition of the present disclosure to a fire. For example, the composition comprises MAP and potassium chloride. The weight percentage of MAP in the composition can be in a range of between about 50% and about 99%. The weight percentage of potassium chloride in the

composition can be in a range of between about 1% and about 49%. In some embodiments, the weight percentage of MAP is about 65%-75%, and the weight percentage of potassium chloride is about 25%-35%. In one embodiment, the composition comprises about 70 weight percent of MAP and about 25 weight percent of potassium chloride. In another embodiment, the weight percentage of MAP is about 70%, and the weight percentage of potassium chloride is about 20%. In one embodiment, the total weight percentage of MAP and potassium chloride can be more than 90%.

[0018] The present disclosure also includes a fire extinguisher having the compositions described herein. The fire extinguisher can include any suitable container. The composition of the fire extinguisher comprises MAP and potassium chloride. The weight percentage of MAP in the composition can be in a range of between about 50% and about 99%. The weight percentage of potassium chloride in the composition can be in a range of between about 1% and about 49%. In some embodiments, the weight percentage MAP is about 65%-75%, and the weight percentage of potassium chloride is about 25%-35%. In one embodiment, the composition comprises about 70 weight percent of MAP and about 25 weight percent of potassium chloride. In another embodiment, the weight percentage of MAP is about 70%, and the weight percentage of potassium chloride is about 20%. In one embodiment, the total weight percentage of MAP and potassium chloride can be more than 90%.

[0019] The following examples describe the manner and process of making and using the compositions of the present disclosure.

[0020] Fire extinguishing capacity can be rated according to widely known industry standards, for example ANSI/UL 711: Rating and Fire Testing of Fire Extinguishers. The ANSI/UL 711 ratings are described using numbers preceding the class letter, such as 1-A:10-B:C. The number preceding the A multiplied by a factor of 1.25 gives the equivalent extinguishing capability in gallons of water. The number preceding the B indicates the size of fire in square feet that an ordinary user should be able to extinguish. There is no additional rating for Class C, as it only indicates

that the extinguishing agent will not conduct electricity, and an extinguisher will never have a rating of just C.

[0021] All performance testing was done according to UL711.

[0022] Composition **1**

INGREDIENT	WT%
MAP	68.99
Potassium Chloride	23
ATTAPULGITE CLAY	4.93
MICA	1.64
SILICONE	0.78
YELLOW PIGMENT	0.016
FLO-GARD	0.66
WATER	0.0006

[0023] Comparative Composition **2** (Control)

INGREDIENT	WT%
MAP	91.99
ATTAPULGITE CLAY	4.93
MICA	1.64
SILICONE	0.78
YELLOW PIGMENT	0.016
FLO-GARD	0.66
WATER	0.0006

[0024] Composition **1** includes MAP, potassium chloride, and other additives. Composition **2** includes MAP and other additives. According to the testing results, composition **1** maintained Class A, B, and C performance as an extinguishing agent while being less expensive compared to conventional extinguishing compositions. Furthermore, because potassium chloride has Class B performance, composition **1** retained or improved Class B performance. Without wishing to be bound by any theory, this may be accomplished by the combination of potassium chloride and MAP extinguishes a large fire into small flames and then MAP is able to extinguish the remaining small flames.

[0025] Many modifications and other embodiments of the present disclosure will come to mind to one skilled in the art to which the present disclosure pertains having the benefit of the teachings presented in the foregoing description, and it will be apparent to those skilled in the art that

variations and modifications of the present disclosure can be made without departing from the scope or spirit of the present disclosure. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

WHAT IS CLAIMED IS:

1. A fire extinguishing composition comprising monoammonium phosphate and potassium chloride.

2. The composition of claim 1, wherein the weight percentage of monoammonium phosphate is in a range of between about 51% and about 99%, and the weight percentage of potassium chloride is in a range of between about 1% and about 49%.

3. The composition of claim 1, wherein the weight percentage of monoammonium phosphate is in a range of between about 65% and about 75%, and the weight percentage of potassium chloride is in a range of between about 25% and about 35%.

4. The composition of claim 1 consisting essentially of monoammonium phosphate and potassium chloride.

5. The composition of claim 4, wherein the weight percentage of monoammonium phosphate is in a range of between about 51% and about 99%, and the weight percentage of potassium chloride is in a range of between about 1% and about 49%.

6. The composition of claim 1, further comprising at least one additive selected from the group consisting of clay, poly(methylhydrogen)siloxane, water, silica, mica, ammonium sulfate, and combinations thereof.

7. The composition of claim 1, wherein the total weight percentage of monoammonium phosphate and potassium chloride is more than about 90%.

8. The composition of claim 1, wherein monoammonium phosphate and potassium chloride are in the form of powder.

9. The composition of claim 8, wherein the powder has an average particle diameter of from about 10 to about 100 μm.

10. The composition of claim 8, wherein the powder is siliconized.

11. A method of extinguishing a fire comprising applying a composition to the fire, wherein the composition comprises monoammonium phosphate and potassium chloride.

12. The method of claim 11, wherein the composition comprises monoammonium phosphate by weight percentage in a range of between about 51% and about 99%, and potassium chloride by weight percentage in a range of between about 1% and about 49%.

13. The method of claim 11, wherein the composition consists essentially of monoammonium phosphate and potassium chloride.

14. The method of claim 11, wherein the composition further comprises at least one additive selected from the group consisting of clay, poly(methylhydrogen)siloxane, water, silica, mica, ammonium sulfate, and combinations thereof.

15. The method of claim 11, wherein the composition consists essentially of monoammonium phosphate, potassium chloride, clay, poly(methylhydrogen)siloxane, water, silica, mica, and ammonium sulfate.

16. A fire extinguisher comprising a composition of monoammonium phosphate and potassium chloride.

17. The fire extinguisher of claim 16, wherein the composition consists essentially of monoammonium phosphate and potassium chloride.

18. The fire extinguisher of claim 16, wherein the composition further comprises at least one additive selected from the group consisting of clay, poly(methylhydrogen)siloxane, water, silica, mica, ammonium sulfate, and combinations thereof.

19. The fire extinguisher of claim 16, wherein the composition comprises monoammonium phosphate by weight percentage in a range of between about 51% and about 99%, and potassium chloride by weight percentage in a range of between about 1% and about 49%.

20. The fire extinguisher of claim 16, wherein the total weight percentage of monoammonium phosphate and potassium chloride is more than 90%.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/027441

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A62D 1/00 (2014.01)
USPC - 252/2
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - A62D 1/00 (2014.01)
USPC - 252/2, 3, 4, 7, 8

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - A62D 1/0014, 1/005, 1/0064 (2014.06)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Google Patents, Public PatFt and AppFt, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3,063,940 A (CAWOOD) 13 November 1962 (13.11.1962) entire document	1, 6, 8, 16, 18
X — Y	US 4,909,328 A (DECHANT et al) 20 March 1990 (20.03.1990) entire document	1, 6, 8-11, 14-16, 18 --- 2-5, 7, 12, 13, 17, 19, 20
Y	US 5,518,075 A (WILLIAMS) 21 May 1996 (21.05.1996) entire document	2-5, 7, 12, 13, 17, 19, 20

☐ Further documents are listed in the continuation of Box C. ☐

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"A" document defining the general state of the art which is not considered to be of particular relevance
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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Date of the actual completion of the international search	Date of mailing of the international search report
24 June 2014	18 JUL 2014

Name and mailing address of the ISA/US	Authorized officer:
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