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

(19) **World Intellectual Property Organization**
International Bureau

(43) **International Publication Date**
20 January 2022 (20.01.2022)

(10) **International Publication Number**
WO 2022/015263 A1

(51) **International Patent Classification:**
A62D 1/00 (2006.01) *C09K 21/00* (2006.01)

(21) **International Application Number:**
PCT/TR2020/051170

(22) **International Filing Date:**
25 November 2020 (25.11.2020)

(25) **Filing Language:** Turkish

(26) **Publication Language:** English

(30) **Priority Data:**
2020/11403 17 July 2020 (17.07.2020) TR

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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, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, 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, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, 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, ST, 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))*

(54) Title: A COMPOSITION FOR EXTINGUISHING FOREST AND METAL FIRES

(57) **Abstract:** The present invention relates to a dry powder composition and liquid solution containing aluminium sulfate and disodium tetraborate to form Aluminium boron sulfate for rapidly cooling fire and flames in all Class A fires, forest fires and Class D light metal fires by way of a fire - resistant surface film coating effective at high temperature ranges (400 - 1600 °C).

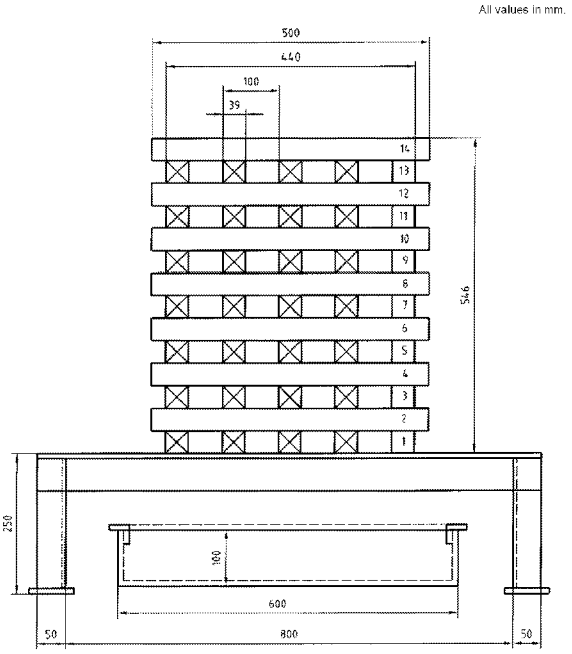

Figure 1

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A COMPOSITION FOR EXTINGUISHING FOREST AND METAL FIRES

Field of the Invention

The present invention relates to a fire - extinguishing composition.

More particularly, the invention relates to a composition for extinguishing and cooling fire and flames in forest and light metal fires by way of a fire - resistant surface film coating effective at high temperature ranges (400 - 1600 ℃).

Prior Art

Water is the most common fire extinguishing agent used in the world for forest fires and Class A fires. Agents that expand in water (foam) are also used for this purpose. Temperatures can rise up to 1000 ℃ during fires at forests, industrial zones or residential areas. The water used in fighting such fires starts boiling at 100 ℃ and evaporates, while the hydrogen is released at 108 ℃ and the remaining oxygen further fuels the fire. This is why it takes long to extinguish fires with water in hot and windy conditions and success rate drops in these operations.

Agents that expand in water (foam) are the other commonly used materials used in fighting such fires. These agents dry and perish when faced with high heat. The extinguishing process is based on covering the burning substance to stop it from coming into contact with oxygen. Extinguishing fails if the burning substance cannot be covered in full. Foam products do not “prevent or retard the spread of flames” and are not used in helicopters and airplanes due to their light weight. However, they can be used in hydrocarbon fires (Class B) to cover the surface like a blanket to remove oxygen. Moreover, there are published reports on the toxic effects of perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) contained in actively used AFFF concentrates (EPA - USA 2016).

Flame retardant is another material used for preventing and retarding fires. Retardant is only used as a flame retardant and has no fire - extinguishing are only used as flame retardant and has no fire extinguishing capabilities, with limited cooling effect. Widely used retardants include “ammonium phosphate dibasic” as the main component and as stated in the MSDSs published by World Health

Organization on behalf of ILO and WHO, “It may produce irritant or toxic fumes (or gases) in case of fire.” Since it melts at 155 ℃, it is ineffective at high temperatures up to 1000 ℃.

Light metal aluminium, lithium, magnesium, titanium, zirconium, zinc, barium, uranium, plutonium, sodium, potassium and calcium etc. metal fires starting with internal combustion can rise up to extreme temperatures of up to 1000 ℃ and are not easy to extinguish. Water and ABC / BC Dry Chemical Powders may not be used in such D Class fires. However, materials can be used to cover the fire and remove oxygen with a thick layer, therefore light metal fires constitute a separate fire - extinguishing class, namely D Class.

In order to eliminate the abovementioned disadvantages, fires reaching 400 ℃ or above require fire - resistant compositions that can remove oxygen and extinguish materials burning at 400 - 1600 ℃, resist to such extreme temperatures, include natural components in the form of organic matter derivatives, not evaporate rapidly under high temperature and fire conditions, prevent and cool the spread by resisting to heat and fire and prevent rekindling and reignition.

Offenlegungsschrift 2 023 374 patent describes a dry powder fire extinguishing agent which contains different powders (carbonates, borax, magnesium oxides, etc.) and is to be applied by means of adhesives. The main component is called perlite. Since this material is extremely hygroscopic, the shelf life is limited. In addition, since it has a very large active surface much "water - based adhesive" must be used. In case of fire, however, this can serve as an oxygen depot for the fire and in particular further fuel metal fires. These adhesives are already on the powder and should be melted on the fire and thus glue the powder.

Patent application no. EP 0395322 B1 relates to a method for extinguishing a burning metal fire and a fire extinguishing agent suitable thereof. Here, a mixture of boron oxide and hydrophobized glass beads of 20 - 200 microns are used. In this case, between 70 and 95 % boron oxide are used. The glass spheres used are so - called cenospheres (waste materials from coal combustion), which naturally fluctuate greatly in their properties and work uncontrollably in a reactive manner. These particles are hydrophobized to avoid sticking in the bearing.

However, the extinguishing powder according to the invention is not "stickable" and thus suitable only for horizontal fires.

Patent application no. US 3,475,322 uses a powder mixture of metallophilic compounds such as SiC and zirconium boride in combination with hollow glass spheres of a size of less than 35 µm. Also in this case it is, as with all materials described so far dust - like powder.

Patent application no. DE 10 2006 019739 A1 describes a “temperature - resistant” round granules and a “spray system”. The invention uses a combination of cenospheres and borosilicate glass. It is important that the glass granules have a minimum of 10 % alumina, better>30 %. Ideally, only borosilicate glass is used.

Patent application no. DE 10 2016 011955 A1 is developed with glass silicates and phosphates. Moreover, it is recommended to use a heating aerosol. The fire extinguishing agent according to the invention comprises temperature - resistant, hollow and round pellets in the form of hollow glass beads or hollow ceramic balls, where the glass material comprises silicon dioxide, aluminium oxide and ferric oxide.

Patent application no. US 2349980 A and CN101073696 A describe fire extinguishing bombs. The said body is formed at its end remote from the detonating mechanism with an enlarged head portion having a frusto - conical shaped side confronting the explosive powder and at its end adjacent to the detonating mechanism with a circumferential rib presenting oppositely sloping sides to portions of the explosive powder. The said body parts are adapted to direct the particles of fire extinguishing powder when the device is exploded.

Patent application no. US 7261165 B1 relates to a housing unit which includes two parts that define a fire - smothering chemical storing interior volume. The housing unit is transported to a target area of a forest fire by an aircraft and dropped onto the target area. An explosive charge is located inside the housing unit and is detonated when the housing unit impacts the ground. The explosion associated with the detonated charge separates the two parts of the housing and disperses the chemical from the open housing unit.

Patent application no. US 20150196787 A1 relates to a method of extinguishing a Class D fire and one or more other classes of fires and may include a foam and one or more inert gases combined with the foam. As used herein, the term “inert gas” means at least one gas selected from helium, neon, argon, krypton, xenon, and radon in concentrations greater than concentrations naturally occurring in air.

Patent application no. EP 1850919 A4 relates to a fire extinguishing agent for extinguishing multiple classes of fires that may include a foam and at least one inert gas combined with the foam. As used herein, the term "inert gas" means at least one gas selected from helium and argon.

The above inventions which are reported to be developed for all Class A solid forest fires are far from rationality, practical use and the present invention. According to the prior art, there is no invention that can be functionally effective against the same classes of fire (Class A and D).

In conclusion, the drawbacks explained above and the shortcomings in existing solutions to the problems have necessitated improvement in the related technical field.

Summary of the Invention

The present invention relates to a composition which satisfies the requirements listed above, eliminates the disadvantages of the prior art while bringing new benefits to the technical field by stopping oxygen absorption through immediate decomposition in case of direct contact with a temperature of 400 ℃ or higher with direct use or application with all types of fire extinguishing agents and equipment with or without pressure or by way of storing in fire extinguisher tubes, back pumps, fire hydrants, fire pools, forest and fire sprinklers, helicopters, firefighting aircrafts, etc. and applying the same or similar methods; with 10 times more fire extinguishing power in advanced, accelerated, unsuppressible, inextinguishable fires compared to water and foams expanding in water and 5 times more fire suppression, fire barrier creation, fire spread prevention power (depending on melting point) compared to flame retardants.

The primary objective of the invention is to provide a composition in the form of powder or liquid solution available for use in all Class A and D fires at 400 - 1600

℃ high temperature and flame conditions, with the properties of extinguishing such fires in very short times compared to water, foams expanding in water and flame retardants, cooling the burning environment, forming a coating or film layer in surface applications to prevent spread and advance of fire by blocking the oxygen required by fire.

Another objective of the invention is to extinguish unsuppressible forest fires that can last for months in a very rapid and conclusive manner, eliminate the cooling operations that can take days in the case of using water as fire extinguisher, preventing the spread and advance of fire, creating a fire barrier for the same purpose, eliminating the “counter - fire” method applied in certain countries to prevent reburning of forests, thereby conserving the ecological and economic order.

One other objective of the invention is to develop a composition that does not release toxic gases or fumes according to OSHA and NIOSH regulations, thereby providing incombustibility without polluting the environment and risking human health.

Another objective of the invention is to rapidly extinguish, cool and ensure fire safety in industrial site, house, vehicle fires responded by fire departments, and employing the fire and flame spread prevention function of the invention to stop the fire from spreading to nearby buildings.

One other objective of the invention is to extinguish light metal fires in industrial sites by using the decomposition, layer - forming and oxygen removal functions of the agent according to the invention and stop such fires by blocking contact with oxygen.

Another objective of the invention is to provide a solution that is available for use with all fire extinguishing agents and equipment. For this purpose, the solution according to the invention can be used as a rapid / immediate fire extinguishing and cooling agent in all sprinklers, helicopters, firefighting aircrafts, fire pools, fire wells, portable fire extinguishers in powder and / or liquid form.

In order to achieve the objectives specified above, the invention provides an agent which comprises one or a combination of the following having the properties listed thereafter:

- Aluminium sulfate *(hydrated or anhydrous forms)* as a fire - resistant, double complex - forming, PH - stabilizing, fire - retardant, micro - feeding and water softening agent which breaks down at certain temperature ranges to release hydrate;
- Disodium tetraborate *(hydrated or anhydrous forms)* as a mineral resistant to 1575 ℃ with high hydrate content;
- At least one borate - based flame retardant / retardant activator such as trihydroxyboron;
- At least one metal corrosion inhibitor composed of organic acid salts;
- Water and solvent;
- In Class A and D fires, fire extinguishing and flame retarding at temperatures of 400 - 1600 ℃ by the method of “Aluminium Boron Sulfate” formation, lowering heat and temperature under 60 ℃ 30 seconds after application in diluted forms by solving in water, blocking contact with oxygen, decomposing at high temperatures to form a layer;
- Extinguishing fire and flames faster than water when formed in a pressure vessel, with higher evaporation temperature compared to water;
- In case of fire, cooling the flames at high speed, which can be diluted in water with a range of 1-50 by weight.

According to a preferred embodiment of the invention, the composition is used in liquid form as a rapid extinguisher and incombustibility provider at high temperatures (400 - 1600 ℃) in wood, timber and by - products, furniture, paper, epoxy - coated products, textile products, felt, rubber, tire, polyester, vinyl ester etc. products in the automotive industry, plywood, particleboard, compact laminated flooring, compressed solid products; and as a powerful extinguisher, resistant fire spreading preventer and a rapid cooling agent in all Class A fires, forest fires, fires responded by fire departments and advanced, unsuppressible, inextinguishable fires.

According to another preferred embodiment of the invention, the composition is used as a Class D powder resistant to high heats with extinguisher, cooler, surface cover, layer - formation, oxygen - removal capabilities in industrial light metal fires.

Brief Description of the Drawings

Figure 1 shows the wood configuration used in the testing method pursuant to TS 862 - 7 EN 3 - 7 + A1 standard.

Detailed Description of the Invention

In order to facilitate a better understanding of the present invention, this detailed description demonstrates the fire extinguishing composition according to the invention in a non - limiting manner.

The invention relates to a fire - resistant, surface film coating flame retardant effective at high temperature ranges (400 - 1600 °C) and used for rapidly extinguishing and cooling fire and flames in forest and light metal fires, comprising Aluminium sulfate, disodium tetraborate, at least one activator, at least one inhibitor, and at least one or a combination of a pigment or water.

Table 1: Content of the powder composition according to the invention

Content	Amount preferable by weight (%)	Amount usable by weight (%)
Aluminium Sulfate *(preferably octadecahydrate)*	90	60 - 90
Disodium Tetraborate *(preferably decahydrate)*	5	3 - 10
Flame retardant / retardant activator *(preferably trihydroxyboron)*	4	3 - 6
Corrosion inhibitor *(preferably organic acid salts)*	1	1 - 5

The powder composition according to the invention is based on forming "Aluminium Boron Sulfate" and generally comprises Aluminium sulfate and disodium tetraborate.

Aluminium sulfate, $Al2(SO4)3$ is a fire - resistant, double complex - forming, Ph - stabilizing, fire - retardant, micro - feeding and water softening agent which breaks down at certain temperature ranges to release hydrate. Both hydrated and anhydrous forms of Aluminium sulfate, preferably hexadecahydrate $Al2(SO4)3$ - $16H2O$, octadecahydrate $Al2(SO4)3$ - $18H2O$, heptahydrate $[Al(H2O)6]2(SO4)3$ - $5H2O$ forms, and more preferably Aluminium sulfate octadecahydrate with high hydrate content can be used according to the invention.

One embodiment of the invention comprises 60 - 90 %, preferably 90 % Aluminium sulfate by weight in total composition.

Disodium tetraborate, $Na2B4O7$ is a mineral also known as borax and is resistant to temperatures up to 1575 ℃, with sodium borate, sodium tetraborate or disodium tetraborate being significant boron compounds. Anhydrous (anhydrous sodium tetraborate, $Na2B4O7$) or hydrated forms of disodium tetraborate, preferably pentahydrate, $Na2B4O7$ - $5H2O$ or decahydrate $Na2B4O7$ - $10H2O$, more preferably disodium tetraborate decahydrate with high hydrate content can be used according to the invention.

Another embodiment of the invention comprises 3 - 10 %, preferably 5 % disodium sulfate by weight in total composition.

Another embodiment of the invention comprises, in addition to the above composition, at least one flame retardant / retardant activator, preferably trihydroxyboron, $BH3O3$. Trihydroxyboron, boric acid, orthoboric acid, boracic acid, boron trihydroxide, boron hydroxide, $H3BO3$, $B(OH)3$ also fall within the scope of the invention as the basic form of borate - based flame retardants used to decrease the flash point of combustion materials.

One embodiment of the invention comprises 3 - 6 %, preferably 5 % flame retardant / retardant activator by weight in total composition.

Another embodiment of the invention comprises, in addition to the above composition, at least one corrosion inhibitor, preferably a metal corrosion inhibitor containing organic acid salts. Organic corrosion inhibitors are preferred due to their non - toxic properties. Organic inhibitors are adsorbed in metal surface to form a thin polymeric film, which inhibit corrosion in a wide pH range.

One embodiment of the invention comprises 1 - 5 %, preferably 1 % corrosion inhibitor, more preferably a metal corrosion inhibitor containing organic acid salts by weight in total composition.

Another embodiment of the invention comprises, in addition to the above composition, at least one colouring pigment, preferably ferric oxide. Ferric oxides basically have four colours, namely yellow, red, brown and black and are used for marking the area where the composition according to the invention is applied. According to one embodiment of the invention, the aqueous solution of the composition with ferric oxide according to the invention colours the aerial application area to mark and make it visible.

One embodiment of the invention comprises 0.1 - 0.3 %, preferably 0.1 % pigment by weight in total composition.

The invention relates to a method for applying the powder composition, formed by mixing one or a combination of the above ingredients, on surfaces as a flame retardant agent or on burning metals in Class D fires as a rapid fire extinguishing and cooling agent, or on burning areas in Class A fires directly or by mixing with water.

One embodiment of the invention comprises a liquid solution obtained by diluting the abovementioned dry powder composition with maximum 50 %, preferably 1 - 50 %, and more preferably 5 - 50 % deionized water (pure water, distilled water) by weight.

Accordingly, the invention comprises the method of dissolving the abovementioned dry powder composition in 50 % maximum by weight in 65 - 85 ℃ deionized water to obtain a homogenous mixture and applying the resulting aqueous solution on surfaces as a flame retardant agent or applying directly or by mixing with water in Class A fires as a rapid extinguishing and cooling agent.

A preferred embodiment of the invention relates to a dry powder composition, comprising 90 % Aluminium sulfate octadecahydrate, 5 % disodium tetraborate decahydrate, 4 % trihydroxyboron and 1 % organic acid salts by weight in total composition. Another preferred embodiment of the invention relates to a liquid solution obtained by dissolving the above composition in 50 % by weight in deionized water.

The properties of rapidly extinguishing substances burning with high heat and film forming in the powder or liquid compositions according to the invention are provided by Aluminium sulfate, which has 58 times more molar mass content than water and is used for conditioning water, cleaning, increasing soil fertility in agricultural applications and adjusting pH value of the soil.

The molar mass of water is 18.01528 g / mol. Disodium tetraborate decahydrate ($Na2B4O7.10H2O$) has a molar mass of 381.38 g / mol, whereas Aluminium sulfate ($Al2(SO4)3.18H20$) has a molar mass of 666.42 g / mol in the form of octadecahydrate. The total molar mass is 1047 g / mol. This explains that the derived “Aluminium boron sulfate” has 58 times more molar mass than water. Active substances with high molar content are more resistant to heat and temperature than water. 58 times more molar mass than water means the active substances contain more atomic structures, which in turn results in more resistance to heat and temperature as the primary property of the substance compared to water.

Aluminium boron sulfate is derived when the above materials are formulated in a homogenous way at certain amounts and conditions. Aluminium boron sulfate is formulated in 100 % powder by weight and 50 % liquid by weight. Aluminium sulfate melts in temperatures at or above 400 ℃. This creates an immediate reaction when applied to a substance burning with higher temperature (decomposition effect). A heat - resistant film layer is formed after decomposing in sudden contact at high temperatures. When applied to a fire burning at a high temperature, this fire - resistant, non - volatile layer, which does not evaporate rapidly, removes contact with oxygen and stops oxygen absorption needed by fire (ASTM D 1259: Substance after 2 hours at 100 ℃, 50 .26).

Aluminium boron sulfate functions in sequence when in contact with high temperature. Disodium tetraborate decahydrate decomposes at 70 ℃ binds with trihydroxyboron which decomposes at 170 ℃ to function as a fire retardant and support and trigger dissolution integration of Aluminium sulfate by reducing pH 9.3. This composition results in decomposition effect with the release of heat - resistant molecule hydrate at high temperatures of 1600 ℃. T his mechanism enables formulating three separate factors under a single composition.

Homogenous distribution thanks to its solubility in water during the production process makes it possible to produce the content of the goods in concentrated fashion. Due to its high molecular water content, it provides intense, heat - resistant humidity and wetness at the applied surface. Again, for the same purposes, it very rapidly extinguishes materials at high heat conditions compared to water, helps the material absorb and resist the heat thanks to Aluminium hydroxide, which is the active substance of Aluminium sulfate, thereby enabling cooling at high speed by forming a film layer. In the prior art, Aluminium sulfate is obtained by adding sulphuric acid to Aluminium hydroxide or by heating Aluminium metal in a sulphuric acid solution as a double Aluminium salt with hydrolysis affinity.

Wetness and humidity are provided with the release of molecule hydrate at high temperatures of 400 ℃, while removal of oxygen, he at reduction and prevention of spread is ensured by the decomposition, extinguishing and cooling effects.

Disodium tetraborate decahydrate ($Na2B4O7.10H2O$) boils at 1575 ℃. It is a natural mineral resistant to high temperatures. Moreover, it is a powerful natural disinfectant with antiseptic, antifungal and antibiotic properties. Disodium tetraborate decahydrate contains high amount of hydrate and breaks down at certain temperature ranges after 70 ℃ to release h ydrates.

Trihydroxyboron, $BH3O3$, is a mineral acid active in flame retardation and melts at 170 ℃.

Another application substance is metal inhibitors with different variations. The suitability of inhibitors is based on the structure of metals used; many being prepared with special mixtures. Inhibitor is determined according to a loss of mass test.

Another effective corrosion preventing method for the necessary applications is through the use of inhibitors. Inhibitors are additives added to corrosion medium to reduce or prevent corrosive effect.

These materials typically operate as forming a protective and impermeable layer functioning as a barrier at metal surface to prevent the corrosive medium from reaching the metal. In order to provide an effective barrier, the inhibitor needs to continuously and uninterruptedly interact with the metal without being reactive to the metal.

One of the most common areas for corrosion inhibitors is acidic surface cleaning (pickling) bath applications. Chemical effective for acidic surface cleaning in terms of corrosion inhibitors are particularly known as “acid inhibitors”. By using these additives, the corrosive effect on the processed side of metal is kept under control and damage to the main metal is prevented by.

CLASS A

The agent according to the invention forms a layer wetter and more humid than water on both flat and complex surfaces (forest vegetation, automotive tires, wooden pallets) and other applied surfaces according to the standard model thanks to its disodium tetraborate decahydrate content. Aluminium sulfate used for forming a film layer and blocking oxygen absorption and trihydroxyboron, an activator with flame retardant resistance is homogenously mixed in water at 80 ℃ to derive Aluminium Boron Sulfate with high water molar mass and high heat resistance. A suitable inhibitor is added to the composition.

Disodium tetraborate decahydrate and Aluminium sulfate are water - soluble materials that contain hydrate resistant to high heat conditions. They dissolve in high heat and release hydrate. This composition also enables more efficient operation on forest vegetation and soil without leading to any environmental toxicological degeneration.

When applied on a surface, Aluminium boron sulfate creates a thin layer that does not deform in a fast manner under normal weather conditions. The applied surface releases hydrates when faced with a flame of 400 ℃, whereas it decomposes and creates a layer to stop oxygen absorption at temperatures above 400 ℃.

This operation prevents the surface from burning thanks to its wetness provided by heat - resistant hydrates; when applied directly to the fire and flames, rapidly extinguishes the fire with a surface wetter and more humid than water; and again creates cooling effect on fire and flames with a wet surface thanks to its Aluminium hydroxide content.

Failure to rapidly extinguish the fire and flames in all types of fire that require water happens because the water cannot fully perform the desired extinguishing and cooling, since the water evaporates at 100 ℃ and h ydrogen evaporates at 108 ℃. While water extinguishes the fire, it is not possible to stop the spread of fire in time, which leads to burning and destruction of big areas. By using water molecules as a carrier agent, the composition evaporates at a later stage than water when confronted with water and extinguishes fire and flames at a quick pace by ensuring immediate and rapid extinguishing and cooling at the applied surface.

CLASS D

Another field of application of the invention covers Class D, internal combusting light metal fires. Due to the status of such fires, it is necessary to use agents with the properties of preventing and blocking fire and flames, forming a film and blocking oxygen to extinguish and cool the fire.

According to the invention, this function is performed by the Aluminium hydroxide ($Al(OH)3$) mineral (hydrargillite) contained in Aluminium sulfate ($Al2(SO4)3$) in amphoteric form. It melts at 300 ℃ and is not solu ble in water. Similar to magnesium hydroxide and huntite and hydromagnesite mixtures, Aluminium hydroxide is also used a flame retardant filler in polymer applications. It decomposes at around 180 ℃ (356 ℉), while absorbi ng a significant amount of heat and releasing water vapour in the process. Besides functioning as a flame retardant, it is also effective as a smoke suppressor in various polymers, particularly in polyesters, acrylics, ethylene vinyl acetate, epoxies, PVC and rubber products.

When combined with disodium tetraborate decahydrate ($Na2B4O7.10H2O$) at certain amounts, it starts to decompose and melt at high temperatures. It reacts with oxygen in case the closed and covered medium melting at high temperature contacts with oxygen from the outside, forcing the substances to form a layer.

Since the resulting layer is impermeable to oxygen from the outside, it stops the fire thanks to its smoke and heat absorbing capabilities.

APPLICATION EXAMPLES

"ASTM" test method is the American National test method standard for fire extinguishing agents with international recognition and applicable regulations. This test method is applicable in many countries. In EU countries, the “EN” norm covers the standards that have international recognition. Pursuant to this framework and standards, the criteria related to Class A fire extinguishing agents apply with certification.

In accordance with this regulation TS 862 - 7 EN 3 - 7 + A1 and TSE K 564 standards apply to all liquid products for Class A solid object fires and portable fire extinguishers are used depending on the scope of fire.

According to the measures prescribed in the legislation and standards, heptane in an amount to burn for 3 minutes was placed in a tray with a metal pan covering the same at a predetermined length and range, followed by placing 8 * 8 * 80 cm long yellow pine flammable material containing 5 % humidity on top of it arranged diagonally at the width and length in the predetermined form with 5cm between each piece.

After igniting the heptane, it took 2 minutes to burn the flammable material, then the tray was drawn away. After that, the flammable material burned for 6 minutes. The prepared flammable material took a glowing form. After waiting for an additional minute, the product was applied to the burning material in the filling amount as described in the applicable standard (6 lt) by using the fire extinguisher. During the drill, it was observed, recorded and documented that the composition according to the invention rapidly and immediately extinguished the fire, the heat dropped below 60 °C after 30 seconds as measured by a digital thermometer, the burning material was held with bare hands after 1 minute, and no reignition took place in the burning materials 3 minutes after it was extinguished, as described in the standard model.

Other application examples performed with the composition according to the invention are as follows:

A napkin was soaked to the half with 100 % pure form of 6 different foam products, recommended for use at 3 - 6 %. Then, it was dried with heat flow. The napkin was vertically ignited from the non - soaked side. The napkin fully burned. (Foam products don’t have fire suppressing properties)

Wood particles pulverized by thinner were ignited. The composition was used to extinguish the fire when the flames rose high. Flames vanished very quickly despite using thinner as the igniter.

In a drill carried out with the Department of Forestry officials, various forest vegetation covers were used:

In a certain stage of the first application, a barrier was created by soaking a part of the flammable material before setting it on fire. It was observed that the flames did not reach the barrier line, slowed down and extinguished after getting trapped in that portion.

In the second application, the composition was used after igniting the flammable material. It was observed that the product very rapidly extinguished the fire, the flames did not reglow, reignite or burn again.

The third application was performed on thin pine branches with high pine resin content in the same body of vegetation. The flammable material was ignited, then extinguished with water. It was observed that water initially extinguished the fire but reignited the flammable material in 1 - 2 minutes. The same result was achieved even after repeating the process 5 times (The same amounts, methods, amounts and equipment were used in the application).

In the fourth application, the foam product used by forestry officials to keep the surface wet and humid were applied to half of the flammable material by way of thick sprinkler hoses. The flammable material was ignited. Despite using foam, it was observed and recorded that flames advanced and fully burned the material.

In the fifth application, Aluminium boron sulfate was mixed with water at an amount of 5 %. Longleaf pine was soaked. After waiting for 24 hours, straw and dry bush was placed under the tree for ignition. But ignition did not take place. A torch was moved closer to thin branches, but they did not burn. These tests were recorded and documented on official documents.

In another application, one metal bowl was filled with water, while another was filled Aluminium boron sulfate. Both bowls were heated to the same degree. While water evaporated, Aluminium boron sulfate formed a layer. Direct fire was applied to the local section of the layer. The local section started glowing. After removing the heat (above 400 ℃), hand contact was establish ed. No heat was found on the surface (25 ℃ with a thermometer).

Another application was performed on vehicle and truck tires. The heat of ignited tires was measured with a thermal camera as 800 ℃. 1 minute after application, the heat value dropped to 50 ℃.

As a light metal, Aluminium powder was ignited with an ignition source. Then, it was heated up with water. Aluminium boron sulfate was sprinkled on the surface. A layer was formed on the surface and the fire stopped.

In all applications, dry powder and liquid forms of the product according to the invention were used in all Class A fires, while the powder form was directly used in Class D fires.

CLAIMS

1. A dry powder composition for fire and flame extinguishing and cooling purposes, which is effective in forest fires and light metal fires at temperatures between 400-1600℃ within the scope of A and D class fires, and which is a flame resistant surface film coater, ***characterized in that;*** the composition comprises aluminium sulfate and disodium tetraborate to form aluminium boron sulfate.

2. The composition according to Claim 1, ***characterized in that;*** the composition comprises 60 - 90% Aluminium sulfate by weight.

3. The composition according to Claim 1 or Claim 2, ***characterized in that;*** Aluminium sulfate is in its hydrated or anhydrous forms; preferably in hexadecahydrate, octadecahydrate or heptahydrate forms; more preferably Aluminium sulfate octadecahydrate form.

4. The composition according to Claim 1, ***characterized in that;*** the composition comprises 3 - 10 % disodium tetraborate by weight.

5. The composition according to Claim 1 or Claim 4, ***characterized in that;*** disodium tetraborate is in its hydrated or anhydrous forms; preferably in pentahydrate or decahydrate forms; more preferably in disodium tetraborate decahydrate form.

6. The composition according to Claim 1, ***characterized in that;*** the composition further comprises at least one flame retardant / retardant activator.

7. The composition according to Claim 6, ***characterized in that;*** the composition comprises 3 - 6 % flame retardant / retardant activator by weight.

8. The composition according to Claim 6 or Claim 7, ***characterized in that;*** the flame retardant / retardant activator is trihydroxyboron.

9. The composition according to Claim 1, ***characterized in that;*** the composition further comprises at least one corrosion inhibitor.

10. The composition according to Claim 9, ***characterized in that;*** the composition comprises 1 - 5 % corrosion inhibitor by weight.

11. The composition according to Claim 9 or Claim 10, ***characterized in that;*** said corrosion inhibitor is constituted of organic acid salts.

12. The composition according to any of the preceding claims, ***characterized in that;*** the composition comprises 90 % Aluminium sulfate octadecahydrate, 5 % disodium tetraborate decahydrate, 4 % trihydroxyboron, and 1 % organic acid salts by weight.

13. The composition according to Claim 1, ***characterized in that;*** the composition further comprises at least one pigment.

14. The composition according to Claim 13, ***characterized in that;*** the composition comprises 0.1 - 0.3 % pigment by weight.

15. The composition according to Claim 13 or Claim 14, ***characterized in that;*** said pigment is ferric oxide.

16. A liquid solution comprising aqueous solution in deionized water of the dry powder composition said in any of the preceding claims.

17. The liquid solution according to Claim 16, ***characterized in that;*** the aqueous solution comprises maximum 50 % of the said dry powder composition by weight.

18. A method for extinguishing Class D fires, ***characterized in that;*** the method comprises applying of the dry powder composition mixture said in any of the Claims 1 to 15 is directly to a burning metal.

19. A method for extinguishing Class A fires ***characterized in that;*** the method comprises applying of the dry powder composition said in any of the Claims 1 to 15 to the burning area directly or by mixing with water.

20. A method for extinguishing Class A fires, ***characterized in that;*** the method comprises applying the liquid solution said in Claim 16 or Claim 17 to the burning area directly or by mixing with water.

21. Use of the dry powder composition said in any of the Claims 1 to 15 as a flame retardant / retarding agent.

22. Use of the liquid solution said in Claim 16 or Claim 17 as a flame retardant / retarding agent.

All values in mm.

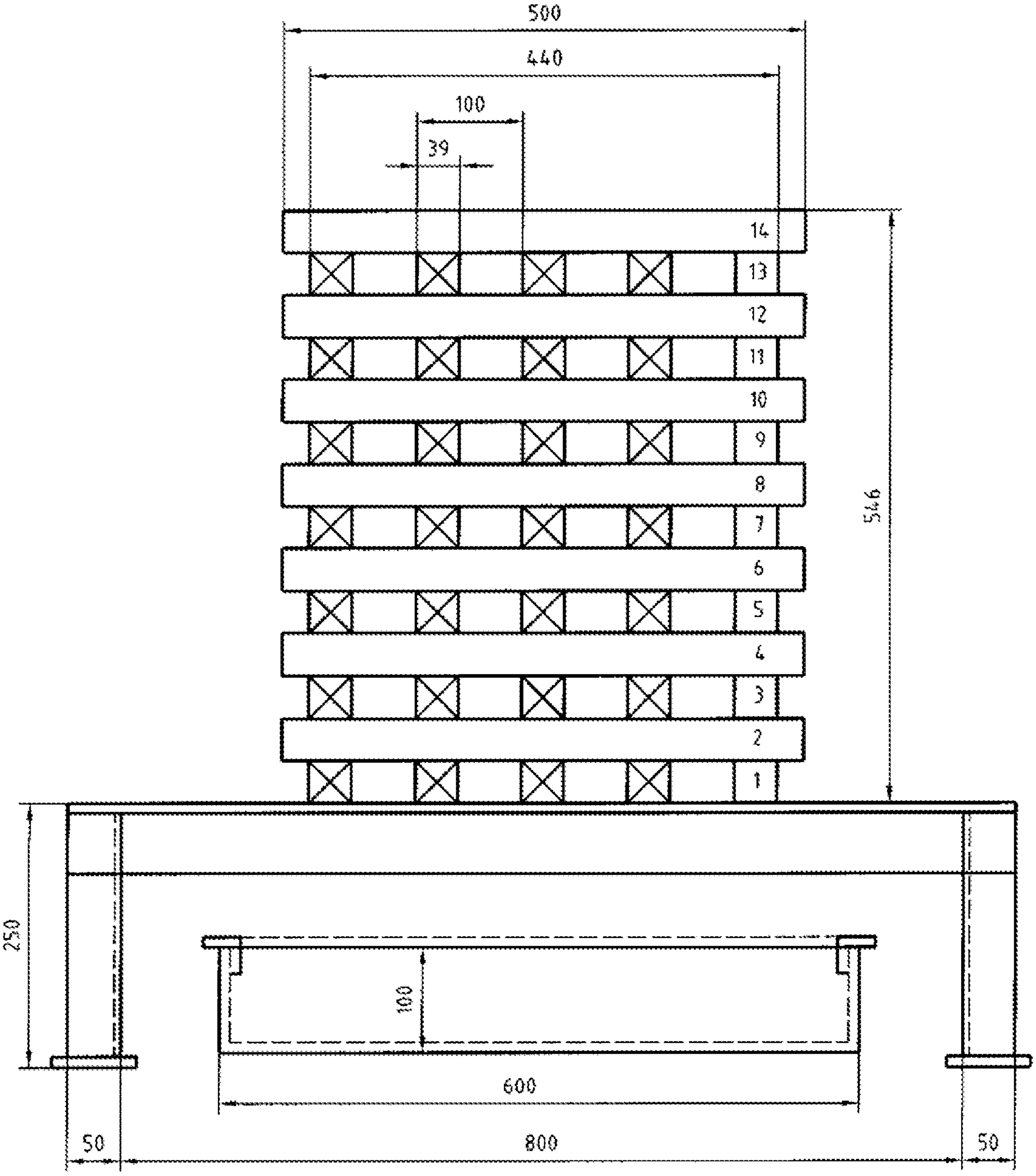

Figure 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/TR2020/051170

A. CLASSIFICATION OF SUBJECT MATTER

A62D 1/00 (2006.01)i; C09K 21/00 (2006.01)

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)

A62D 1/00; C09K 21/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4184969 A (BHAT IND INC [US]) 22 January 1980 (1980-01-22) Description column 2 lines 5-13	1,3,5,6,8-11,13-22
A	EP 2173836 A1 (BUDENHEIM IBERICA S L SOC EN COMANDITA [ES]) 14 April 2010 (2010-04-14) Description par.60	1-22
A	US 2016030789 A1 (GEITECH SOLUTIONS INC [US]) 04 February 2016 (2016-02-04) The whole document	1-22

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

☑ See patent family annex.

* Special categories of cited documents:

"A"	document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"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
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search	Date of mailing of the international search report
30 April 2021	**30 April 2021**

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/TR2020/051170

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
US	4184969	A	22 January 1980	NONE			
EP	2173836	A1	14 April 2010	WO	2008155187	A1	24 December 2008
				PT	2173836E	E	08 September 2014
				US	2010200819	A1	12 August 2010
				CA	2691080	A1	24 December 2008
				ES	2288442	A1	01 January 2008
				ES	2496169T	T3	18 September 2014
US	2016030789	A1	04 February 2016	NONE			