

Oct. 22, 1974

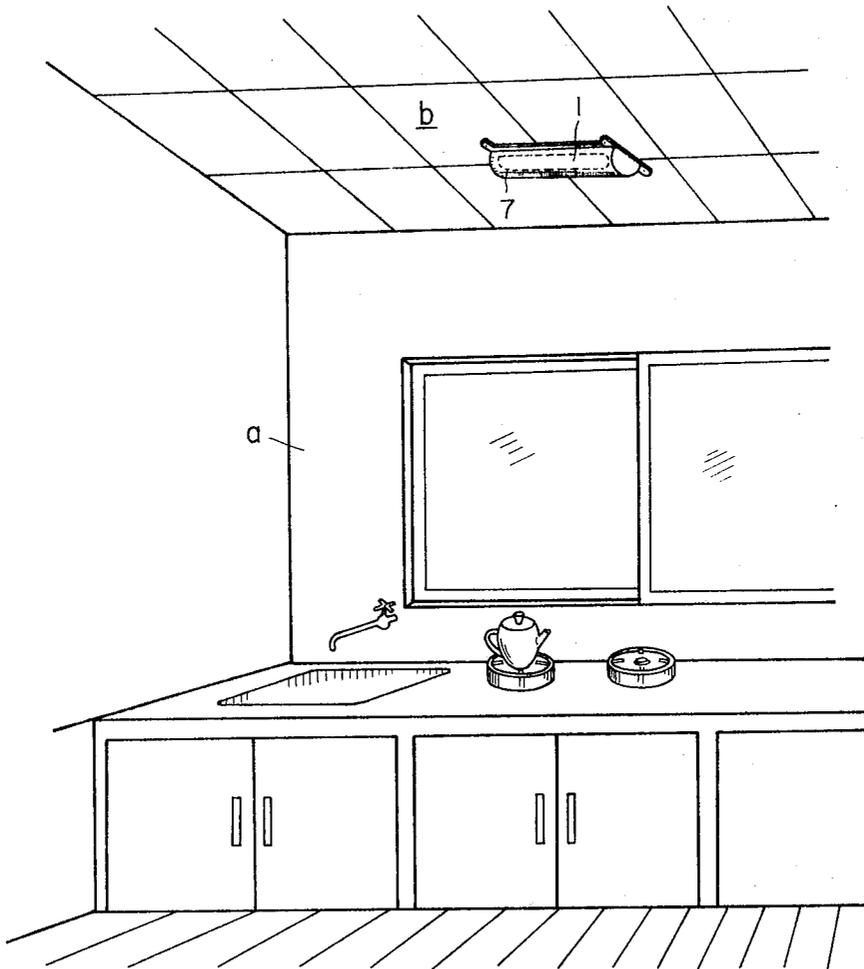
YASUZO HATTORI ET AL
METHOD OF EXTINGUISHING FIRES

3,843,525

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2 Sheets-Sheet 1

FIG. 1



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FIG. 2-B

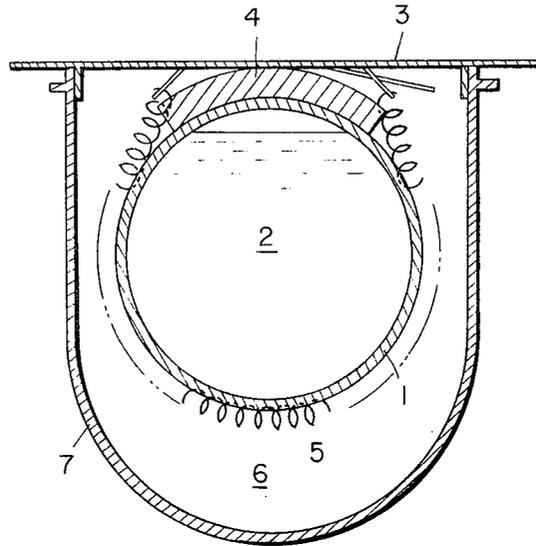
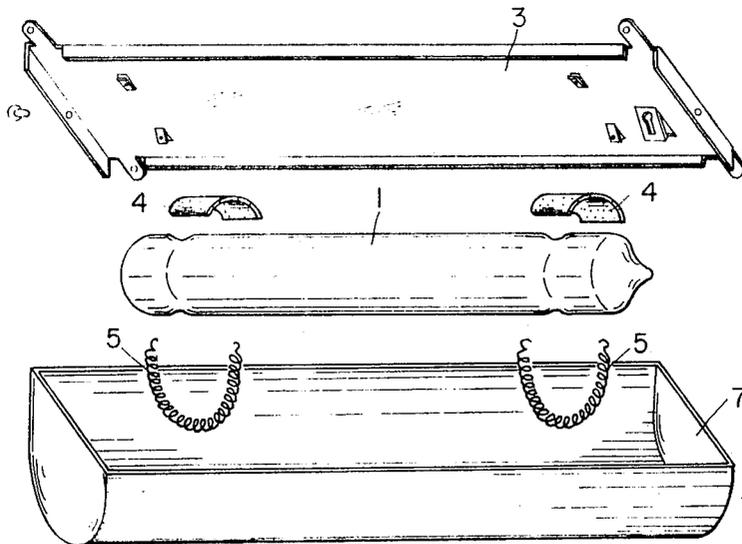


FIG. 2-A



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METHOD OF EXTINGUISHING FIRES

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Int. Cl. A62c 1/00; A62d 11/00

U.S. Cl. 252-2

4 Claims

ABSTRACT OF THE DISCLOSURE

A fire-extinguishing composition and a fire extinguisher device for use thereof are presented. Said fire-extinguishing composition comprises a composition having the following components in approximately the proportions by weight as indicated:

	Parts by weight
Burnt alum	7.0-7.5
Ammonium carbonate	6.0-6.2
Sodium chloride	3.5-4.0
Calcium chloride	4.0-4.5
Anhydrous sodium carbonate	2.0-3.0
Water glass	25.0
Calcium carbonate	1.0-1.5
Magnesium carbonate	1.0-1.5
Sodium bicarbonate	10.0-10.5

The fire-extinguisher device is made by placing the said fire-extinguishing composition into a container which is adapted to break into small pieces instantaneously upon heating at a low temperature below 100° C. When said container is heated at the initial stage of a fire incident, the container is forced to break by the rising inner pressure generated from the said fire-extinguishing composition. This enables the said fire-extinguishing composition contained therein to split out in all directions and fall upon the fire to extinguish the same.

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to a fire-extinguishing composition and a fire extinguisher for the application thereof. The invention also relates to a method of extinguishing fires, as well as to a method of making a fire extinguisher.

In the conventional methods of fire extinguishment, chemicals are used in some cases in addition to water in order to stop the burning. Most of these chemicals extinguish the fire mainly by producing gases, such as carbon dioxide, etc. However, these methods of fire-extinguishing have the disadvantage of the danger that such chemicals as ammonium chloride, carbon dioxide, or their mixtures, etc., are harmful to the firemen and other persons who may be contacted by such gases or chemicals in vaporous form.

One of the purposes of this invention is to provide a disaster-preventing fire-extinguishing composition which is suitable for storage and which extinguishes fires with a relatively small amount of stored water or other water from such sources as rivers or lakes during unexpected earthquakes or other like disasters, when the regular water supply may be cut off. It is an object of the invention to provide a fire-extinguishing composition which can extinguish fires at the initial stage of the fire incident

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by the application of the said fire-extinguishing composition. It is a further object to provide a method and device for fire extinguishment.

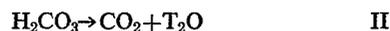
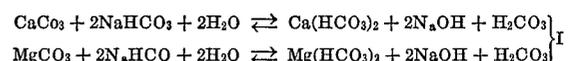
DESCRIPTION OF THE INVENTION

According to the present invention, three components, namely: calcium carbonate, magnesium carbonate and sodium bicarbonate, in addition to ammonium carbonate that produces much more gas, are incorporated into the fire-extinguishing composition. In this manner, a stronger action of fire extinguishment is obtained without producing any harmful gas which might be injurious to human beings or livestock, or which might cause damage to clothes, furniture or other personal property threatened by fire.

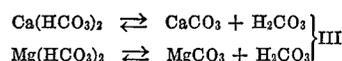
A special feature of the fire-extinguishing composition of the present invention is explained in the following illustration of a fire-extinguishing composition according to the present invention as follows:

	Parts by weight
Burnt alum	7.0
Ammonium carbonate	6.0
Sodium chloride	4.0
Calcium chloride	4.0
Anhydrous sodium carbonate	2.0
Water glass	25.0
Calcium carbonate	1.0
Magnesium carbonate	1.0
Sodium bicarbonate	10.0
Water	40.0
Total	100.0

Although not fully understood, the invention is thought to be explained in part based upon the following theory. Both calcium carbonate and magnesium carbonate are insoluble in water. However, they are changed into water-soluble compounds, e.g., calcium hydrocarbonate and magnesium hydrocarbonate, in a water solution, respectively, upon the addition of sodium bicarbonate, through chemical reactions such as the following:



The NaOH produced in Reaction (I) acts as a material for covering burning articles to stop the extension of the fire. These reactions become vigorous upon heating, and when the reaction mixture is heated at about 60-70° C., both Ca(HCO₃)₂ and Mg(HCO₃)₂ release carbon dioxide readily along with the production of calcium carbonate and magnesium carbonate, respectively, according to the following reactions:



The composition illustrated above is filled and sealed into a container which is adapted to break into small pieces instantaneously upon heating at a temperature below 100° C. When this composition is heated at 60-70° C., carbon dioxide is produced in two steps according to Re-

action (II) and (III). This, along with the generated water vapor, raises the gas pressure inside the container, and results in a sudden expansion of the volume of gases within the container, thus causing the container to burst. The chemicals within the container are sprayed out in every direction. The CO₂ acts as the main fire-extinguishing agent, while the viscous aluminum silicate compounds generated from the water glass, alum, etc., which are the components of the fire extinguishing composition, cooperate with other viscous material, such as sodium dioxide, calcium chloride, etc., to form a fire-proof membrane or covering over the articles which have not yet burned. This stops the extension of the fire and burning. In other words, it is the covering action of these viscous materials and the fire-extinguishing power of the CO₂ gas which works together to effect fire-extinguishing and fire preventing in a surprisingly efficient manner. Moreover, it is to be observed that the CaCO₃ and MgCO₃ which result from Reaction (III) produce CO₂ gas continuously by repeating Reaction (I) and (II) as long as NaHCO₃ exists in the system.

DESCRIPTION OF THE DRAWINGS

The construction and positioning of the fire-extinguisher device of the present invention is explained by the drawings:

FIG. 1 is a perspective view of the fire-extinguisher of the present invention installed in a room of a dwelling or other structure;

FIG. 2-A is an exploded view of the fire extinguisher showing the several parts of the apparatus; and

FIG. 2-B is a vertical sectional view of the fire extinguisher apparatus.

In the drawings, the numerical symbols are identified as follows: 1 is the container which holds the fire extinguishing composition 2 of the present invention. 3 is the supporting frame for the fire extinguisher. 4 represents the cushion material against which the container 1 is held by the spring band 5. There is an air space 6 between the cover 7 and the container 1 which holds the fire-extinguishing composition 2.

As shown in FIGS. 2-A and 2-B, there is a specially strengthened glass container 1 in the form of a cylinder, vessel, or some other type, which breaks into small pieces as soon as the container is heated at an elevated temperature below 100° C. The container is filled with a fire-extinguishing solution 2 prepared according to the present invention and then the container is sealed. Said container is fixed to a supporting frame 3 by means of spring bands 5 with cushion material 4 as interpositioner, and then covered with a cover 7 made of synthetic resin, such as hard polyethylene, etc. If the fire-extinguisher of the present invention is fixed in place somewhere near combustible materials, for example, on the ceiling (b) of a kitchen room (a), the said container 1 bursts into small pieces through the action of spalling (sudden heating and cooling) as the said spring is heated by the burning cover 7 in a fire accident. At the same time, the fire-extinguishing solution originally contained in the said container spreads, e.g., in form of a mist, over the burning articles by means of the gases generated, and thus exerts a strong fire-extinguishing action. Moreover, the number of fire-extinguishers to be used according to the present invention, in this case, is determined on the ability of the fire extinguisher to put out fires. One extinguisher for about every 7-10 m.² is preferable, for example.

In another embodiment, the fire-extinguisher of the present invention is also advantageously hung 10 cm. below the ceiling, or fixed on a wall at a place about 10 cm. apart from the ceiling. In any case, it is essential that the fire-extinguisher apparatus be firmly fixed in place on the wall or ceiling.

This invention is further illustrated in detail by the following examples. However, the scope of the present invention should not be limited by them.

EXAMPLE 1

A fire-extinguisher having a glass container was filled with 200 g. of the following fire-extinguishing composition:

	Parts by weight
Burnt alum -----	7.0
Ammonium carbonate -----	6.0
Sodium chloride -----	4.0
Calcium chloride -----	4.0
Anhydrous sodium carbonate -----	2.0
Water glass -----	25.0
Calcium carbonate -----	1.0
Magnesium carbonate -----	1.0
Sodium bicarbonate -----	10.0
Water -----	40.0
Total -----	100.0

The filled extinguisher was fixed on the upper inner wall of a house wherein shavings were heaped. Two liters of a mixture of heavy oil and gasoline were spread thereon and then the shavings were ignited. The fire became stronger and stronger, and 8-17 seconds after ignition, the glass container fixed in the upper side of the room exploded spontaneously owing to the rising flames. Meanwhile, the flames and black smoke changed into a white smoke. The fire was perfectly controlled within 2-5 seconds after the said spontaneous explosion.

EXAMPLE 2

To illustrate the effect of the concentrated solution of fire-extinguishing composition, according to the present invention, the same solution as in Example 1 was made, but the concentrated fire-extinguishing solution was diluted to 100 times by volume and every 200 g. of it was packed into a vinyl bag. When one of the said 200 g.-bags of the fire-extinguishing composition of the present invention was applied to the fire at its strongest stage (13-15 sec. after ignition), the fire was quickly extinguished. In contrast, 4 to 5 of the 200 g.-water-vinyl bags was necessary to extinguish the fire at the same conditions.

Estimation of the efficiency of fire-extinguishment of the fire-extinguishing composition of this invention is made according to the following equations:

(A) Fire extinguishment efficiency of strong, concentrated fire-extinguishing solution:

$$\frac{\text{Amt. of water needed for fire-extinguishment}}{\text{Amt. of diluted fire-extinguishing solution needed for fire-extinguishment}}$$

$$\times \text{degree of dilution} = 400 - 500$$

(B) Fire extinguishment efficiency of diluted fire-extinguishing solution:

$$\frac{\text{Amt. of water needed for fire-extinguishment}}{\text{Amt. of diluted fire-extinguishing solution needed for fire-extinguishment}}$$

$$= 4 - 5 \text{ (for 100 times diluted solution)}$$

The optimal degree of dilution depends upon the kinds of the burning articles and the environments.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. Method of extinguishing fire in a building which comprises using a fire-extinguishing composition consisting essentially of an aqueous solution of

(a) from about 7.0 to about 7.5 parts by weight of burnt alum,

(b) from about 6.0 to about 6.2 parts by weight of ammonium carbonate,

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- (c) from about 3.5 to about 4.0 parts by weight of sodium chloride,
- (d) from about 4.0 to 4.5 parts by weight of calcium chloride,
- (e) from about 2.0 to about 3.0 parts by weight of anhydrous sodium carbonate, 5
- (f) about 25.0 parts by weight of water glass,
- (g) from about 1.0 to about 1.5 parts by weight of calcium carbonate,
- (h) from about 1.0 to about 1.5 parts by weight of magnesium carbonate, and 10
- (i) from about 10.0 to about 10.5 parts by weight of sodium bicarbonate, said composition being kept in a container in the building which container is breakable at elevated temperatures below 100° C. and adapted to extinguish a fire in the building when the heat of the fire causes the container to break and spray the said fire-extinguishing composition over the fire. 15

2. The method of extinguishing fires, as set forth in claim 1, in which the first-extinguishing composition consists essentially:

	Parts by weight
Burnt alum -----	7.0
Ammonium carbonate -----	6.0 25
Sodium chloride -----	4.0
Calcium chloride -----	4.0
Anhydrous sodium carbonate -----	2.0

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	Parts by weight
Water glass -----	25.0
Calcium carbonate -----	1.0
Magnesium carbonate -----	1.0
Sodium bicarbonate -----	10.0
Water -----	40.0
<hr/>	
Total -----	100.0

3. The method of extinguishing fires which comprises using the composition of claim 1, which composition is diluted with up to about 100 parts by volume of water.

4. The method of extinguishing fire which comprises using the composition of claim 2, which composition is diluted with up to about 100 parts by volume of water.

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U.S. Cl. X.R.

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