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(54) **FIRE-EXTINGUISHING AGENT AND FIRE-EXTINGUISHING APPARATUS**

(57) The present invention has an object to provide a fire-extinguishing agent capable of coping with various types of fires such as oil fires, ordinary fires and electrical fires, and quickly extinguishing fires, and a fire extinguisher using the fire-extinguishing agent. The fire-extinguishing agent 11 (12) according to the present invention has, at least, a fire-extinguishing chemical liquid 21 (22) and an insoluble admixture CB having at least one of a

fibrous form, a porous form and a powdery form, mixed in the fire-extinguishing chemical liquid 21 (22), and the fire-extinguishing chemical liquid 21 (22) adheres or otherwise to the insoluble admixture CB. Then, the fire extinguisher 40 (43, 45) according to the present invention comprises a container containing the fire-extinguishing agent 11 (12).

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Description

Technical Field

[0001] The present invention relates to a fire-extinguishing agent capable of quickly extinguishing various types of fires, and a fire extinguisher using the fire-extinguishing agent.

Background Art

[0002] Fire-extinguishing agents generally extinguish fire by any one of or a plurality of actions of the cooling action (action of cooling burning materials), suppressing action (action of suppressing the combustion chemical reaction) and smothering action (action of making oxygen deficient). If fire extinguishers are classified focusing on fire-extinguishing agents, fire extinguishers can be classified into water fire extinguishers, intensified liquid fire extinguishers, foam fire extinguishers, carbon dioxide fire extinguishers, halide fire extinguishers, powder fire extinguishers and the like.

[0003] Such fire-extinguishing agents and fire extinguishers, respectively, cope with various forms of fires (fires of petroleum and the like, ordinary fires, electrical fires and the like). For fire-extinguishing agents, for example, the vulnerability of protein foams is compensated for by the enhancement of the strength of the foams themselves, and the function of fire-extinguishing agents lacking the water film formability is compensated for by the addition of a fluorine-based surfactant or a polymeric agent (Patent Literatures 1 to 4); and for fire extinguishers, for example, a container has been developed which is easily broken when being thrown toward flames (Patent Literature 5).

[0004] In order to extinguish fires of tanks for petroleum and the like, such a technology has also been developed that a floating body housing a dried water glass is previously accommodated in the tanks, and when the floating body is collapsed by heat of flames, the dried water glass leaks out and extinguishes fire. In this technology, the leaked water glass foams by heat of flames and floats on the petroleum surface to reduce air supplied to the petroleum surface and thereby extinguish fires of petroleum and the like (Patent Literature 6).

Citation List

Patent Literature

[0005]

[Patent Literature 1]
Japanese Patent Laid-Open No. 09-173498
[Patent Literature 2]
Japanese Patent Laid-Open No. 2000-126327
[Patent Literature 3]
Japanese Patent Laid-Open No. 2001-079108

[Patent Literature 4]
Japanese Patent Laid-Open No. 2007-252731
[Patent Literature 5]
Japanese Patent No. 3081531
5 [Patent Literature 6]
Japanese Patent Laid-Open No. 2008-206849

Summary of Invention

10 Technical Problem

[0006] In fires of buildings and the like, however, a fire-extinguishing chemical liquid jetted or otherwise (or a fire-extinguishing chemical liquid flowing out from a container thrown in flames) parts into the fire-extinguishing chemical liquid covering a surface of burning materials and residing there and that flowing down from the burning materials, and the flowing-down fire-extinguishing chemical liquid has its fire-extinguishing contribution reduced.

15 **[0007]** In fires of petroleum and the like, although it is desired that a fire-extinguishing chemical liquid quickly diffuses to a liquid surface and covers the liquid surface, some fire-extinguishing chemical liquids sink in liquids. A foamable fire-extinguishing chemical liquid, though being excellent in the point of floating on a liquid surface, can hardly be said to quickly diffuse to the liquid surface. Although these conventional technologies can be said to enhance the diffusibility and the thixotropy of fire-extinguishing agents paying attention to each form of fires, there is undeniably room for improvement of the quick-
20 ness of fire extinction.

[0008] On the other hand, in such a technology that a floating body housing a dried water glass and the like is accommodated in an oil tank in advance, and when a fire occurs, the floating body collapses by heat of flames and the dried water glass leaks out to thereby extinguish the fire, since the dried water glass foams after the floating body collapses by heat and the dried water glass leaks out, there is room for improvement in order to quickly
25 cover a liquid surface. Petroleum and the like having infiltrated into pores of foamed bodies may undeniably contact with air (oxygen) in the vicinity of a liquid surface in a high-temperature environment.

[0009] Further in order to completely cover a liquid surface (flat surface) with foamed bodies of a dried water glass expanding three-dimensionally, a large amount of the dried water glass becomes necessary and a large amount of floating bodies has to be floated on the liquid surface. In the first place, this fire-extinguishing technology is specialized for fires of tanks for petroleum and the like, and cannot be said to be a fire-extinguishing technology to cope with other forms of fires.

[0010] Then, the present invention has an object to materialize a fire-extinguishing agent capable of coping with various fires such as oil fires, ordinary fires and electrical fires, and capable of quickly extinguishing fire, and a fire extinguisher using the fire-extinguishing agent.
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Solution to Problem

[0011] The fire-extinguishing agent according to the present invention to achieve the object described above comprises, at least, a fire-extinguishing chemical liquid, and an insoluble admixture taking at least one of a fibrous form, a porous form and a powdery form mixed with the fire-extinguishing chemical liquid. When the insoluble admixture is mixed with the fire-extinguishing chemical liquid, the fire-extinguishing chemical liquid infiltrates into or adheres to the insoluble admixture.

[0012] Here even in the case where the specific gravity of the insoluble admixture is larger than those of petroleum (specific gravity: about 0.8), gasoline (specific gravity: about 0.7), and the like, since the insoluble admixture takes at least one of a fibrous form, a porous form and a powdery form, the insoluble admixture, even if being thrown in gasoline or the like, is prevented from sinking due to the viscosity of a liquid and comes to stay near a liquid surface for a long time. Therefore, the finer the insoluble admixture, the more hardly the insoluble admixture sinks.

[0013] Therefore, in the case where the fire-extinguishing agent is thrown in flames in fires of petroleum and the like, the insoluble admixture, since floating in the vicinity of a liquid surface of petroleum and the like for a relatively long time, and further since quickly moving due to the thermal energy, diffuses to a broad area of the liquid surface, even in a relatively small amount of the insoluble admixture. The fire-extinguishing chemical liquid adhering or otherwise to the insoluble admixture and thus diffusing quickly extinguishes fire (claim 1). The insoluble admixture, of course, very hardly sinks even if being thrown in gasoline, if the bulk specific gravity is smaller than the specific gravity of gasoline.

[0014] The insoluble admixture comprises at least one of, for example, ceramic beads, ceramic fillers, active carbon, perlite, ligneous fibers, pulps and nonwoven fabrics (claim 2). Here, the ceramic beads have a small bulk specific gravity and hardly sink, are excellent in heat resistance, and are good in diffusibility because of having a spherical shape. The ceramic fillers hardly sink and are excellent in heat resistance. The active carbon and perlite have a small bulk specific gravity and hardly sink, and are excellent in heat resistance. Since the ligneous fibers, pulps and nonwoven fabrics have a small bulk specific gravity and hardly sink, when these are exposed to a high temperature on a liquid surface, the fire-extinguishing chemical liquid instantaneously causes a chemical reaction to thereby quickly extinguish fire.

[0015] Thus, the insoluble admixture suffices if the fire-extinguishing chemical liquid can be absorbed in it or can adhere to its surface, and suffices if it has a flame retardancy in such a degree that the insoluble admixture does not burn at least while the fire-extinguishing chemical liquid causes the chemical reaction (generation of smothering gas, or otherwise) when the insoluble admixture is thrown in flames.

[0016] The fire-extinguishing chemical liquid is what generates carbon dioxide gas or ammonia gas upon thermal decomposition, for example, an inorganic salt aqueous solution, or a mixed chemical liquid of the inorganic salt aqueous solution and a foam fire-extinguishing chemical liquid (claim 3).

[0017] The insoluble admixture is preferably mixed in an amount of 2.5 g or more with respect to 100 mL of the fire-extinguishing chemical liquid when the fire-extinguishing chemical liquid is the inorganic salt aqueous solution alone; and is preferably mixed in an amount of 1.25 g or more with respect to 100 mL of the fire-extinguishing chemical liquid when the fire-extinguishing chemical liquid is the mixed chemical liquid of the inorganic salt aqueous solution and the foam fire-extinguishing chemical liquid (claim 4).

[0018] In the case where the fire-extinguishing agent is thrown in flames of fires of structures and the like, since the insoluble admixture is fine and has a small specific gravity, the insoluble admixture hardly drops off the surface of the structures and the like, and much thereof stays on the surface of the structures and the like; and the flowing-down amount of the fire-extinguishing chemical liquid resultantly becomes small. The insoluble admixture, additionally, quickly moves in the fire-extinguishing chemical liquid by the thermal energy of fires while quickly diffusing to a broad area of the surface of the structures and the like. The fire-extinguishing chemical liquid thus diffusing quickly causes the chemical reaction due to the thermal energy of fires and almost instantaneously generates smothering gas (carbon dioxide gas, ammonia gas) and the like to thereby realize quick fire extinction.

[0019] According to the fire-extinguishing agent, quick fire extinction is thus enabled not only in oil fires but also in fires of structures and the like (ordinary fires and electrical fires). Since the fire-extinguishing chemical liquid exhibits little flowing-down the insoluble admixture diffuses quickly, the fire-extinguishing agent can extinguish fire in a small amount. Reduction in size and weight is therefore enabled for a fire extinguisher using the fire-extinguishing agent.

[0020] The fire-extinguishing agent is contained in a container to provide a fire extinguisher, and the fire extinguisher is thrown or otherwise in flames to break or melt the container to thereby diffuse the fire-extinguishing agent to realize quick fire extinction (claim 5). The container is made into a shape capable of being grasped with a hand, and thrown in flames to break or melt the container to thereby diffuse the fire-extinguishing agent to the liquid surface or the surface of the structures and the like, thereby enabling quick fire extinction (claim 6).

[0021] If the container is previously disposed on at least a part of a structural body, interior material or exterior material of a building, the container is broken or melted by a fire of the building (including breakage based on signals of fire detectors), or the container is artificially broken when the fire occurs, to thereby diffuse the fire-extinguishing chemical liquid, thereby enabling quick fire

extinction (claim 7).

[0022] If the container is previously disposed in a circumference of a structure, when a fire occurs on the structure, the container is broken or melted, or the container is artificially broken, to thereby diffuse the fire-extinguishing chemical liquid, thereby enabling to extinguish the fire (claim 8).

[0023] The containers are previously arranged, for example, so as to surround a circumference (being partially a sea surface in some cases) of petroleum tanks installed near a seashore (in the case of the sea surface, the containers are made to float), and when petroleum flowing out from the petroleum tanks due to disasters, accidents and the like catches fire and the like, the containers are broken or melted due to the fire (including breakage based on a signal of a fire detector), or the container is artificially broken, to thereby diffuse the fire-extinguishing chemical liquid to the circumference of the petroleum tanks, thereby enabling quick fire extinction. Of course, the containers can also be made to float so as to surround ocean petroleum storage tanks (including tankers loading petroleum and the like), and the containers can also be disposed so as to surround buildings such as storehouses.

Advantageous Effects of Invention

[0024] As described above, according to the fire-extinguishing agent and the fire extinguisher using the fire-extinguishing agent according to the present invention, various fires such as oil fires, ordinary fires and electrical fires can be extinguished quickly. Further according to the present invention, the amount of the fire-extinguishing agent necessary for fire extinction can be reduced (that is, the fire extinguisher can be reduced in size).

Brief Description of Drawings

[0025]

[Figure 1] Figure 1 is a view illustrating a cross-sectional schematic structure of a drum can used in a fire extinction experiment.

[Figure 2] Figure 2 is a view to interpret a schematic structure example in one Example of the fire extinguisher according to the present invention.

[Figure 3] Figure 3 is a view to interpret a schematic structure example in another Example (an example of a fire extinguisher disposed on a structural body of a building) of the fire extinguisher according to the present invention.

[Figure 4] Figure 4 is a view to interpret a schematic structure example in another Example (an example of a fire extinguisher disposed on a sea surface) of another fire extinguisher according to the present invention.

Description of Embodiments

[0026] Hereinafter, the fire-extinguishing agent and the fire extinguisher according to the present invention will be described by reference to the drawings and others.

Examples

[0027] The present inventor, in order to confirm the effects of an insoluble admixture in the fire-extinguishing agent according to the present invention, carried out fire extinction experiments of the fire-extinguishing agent according to the present invention, and fire extinction experiments of comparative fire-extinguishing agents in which no insoluble admixture was mixed.

<Fire-extinguishing agent>

[0028] Experiments were carried out for a fire-extinguishing agent 11 and a fire-extinguishing agent 12. The fire-extinguishing agent 11 was prepared by mixing hollow ceramic beads "E-SPHERES" (registered trademark, particle diameter range: 20 to 300 μm , hereinafter, ceramic beads CB), made by Taiheiyo Cement Corp., as an insoluble admixture in a mixed chemical liquid 21, which is an inorganic salt aqueous solution of anhydrous sodium carbonate (5% by weight), diammonium hydrogenphosphate (7% by weight), ammonium sulfate (3% by weight) and ammonium bicarbonate (3% by weight). Then, the fire-extinguishing agent 12 was prepared by mixing 3% (% by volume) of a fluorine-based foam fire-extinguishing agent ("Fukada Fluorowater F" (trade name), made by Fukada Kogyo Co., Ltd.) in the mixed chemical liquid 21 to thereby make a mixed chemical liquid 22, and further mixing the ceramic beads CB as an insoluble admixture thereto.

[0029] For example, when 15 g of the ceramic beads CB was mixed in 600 mL of the mixed chemical liquid 21 and stirred, and left to stand, almost no sedimentation of the ceramic beads CB was observed (visually), and the volume the ceramic beads CB occupied was about 1/8 of the total volume of the mixture, and the ceramic beads CB floated (visually) in the vicinity of the liquid surface. The case of the mixed chemical liquid 22 was similar.

<Comparative fire-extinguishing agents>

[0030] A comparative fire-extinguishing agent 1 is composed only of the mixed chemical liquid 21, and a comparative fire-extinguishing agent 2 is composed only of the mixed chemical liquid 22 (in the comparative fire-extinguishing agents 1 and 2, no ceramic beads CB are mixed).

<Fire extinction experiment>

[0031] Figure 1 is a view illustrating a cross-sectional schematic structure in the longitudinal direction of a drum

can 30 used in a fire extinction experiment. The drum can 30 has a diameter of about 60 cm, and has a barrel plate 31 and a ground plate 32; and a top plate opposing to the ground plate 32 is removed. A fire-extinguishing agent inlet 33 is installed at a position of about 25 cm from the ground plate 32; and a fire-extinguishing agent-introducing pipe 34 is connected to the fire-extinguishing agent inlet 33 from the outside of the drum can 30. Therefore, a fire-extinguishing agent injected in the fire-extinguishing agent-introducing pipe 34 flows down from the fire-extinguishing agent inlet 33 to an interior space 30s of the drum can 30 (flowed down nearly toward the central direction of the ground plate 32). However, if the fire-extinguishing agent is thrown in the central direction of the ground plate 32, the fire-extinguishing agent spread directly across the liquid surface of gasoline 4 by the operation alone, and the diffusibility of the fire-extinguishing agent on the liquid surface of the gasoline 4 cannot be evaluated.

[0032] Then, on a position of a barrel plate inner peripheral surface 31a right under the fire-extinguishing agent inlet 33 and at about 20 cm from the ground plate 32, a nearly rectangular-shape water stop plate 35 is attached obliquely upward. Therefore, the fire-extinguishing agent flowing down from the fire-extinguishing agent inlet 33 to the interior space 30s of the drum can 30 is changed into the flowing-down direction by the water stop plate 35, and parts and flows down a barrel plate inner peripheral surface 31a in two directions of clockwise and counterclockwise. By thus making the fire-extinguishing agent to flow down, the diffusibility of the fire-extinguishing agent on the liquid surface of the gasoline 4 can be evaluated.

[0033] A fire extinction experiment was carried out by charging 10 L of water 3 in the drum can 30, igniting gasoline 4 following addition of 1 L of the gasoline 4, and at 30 seconds after the ignition, charging the fire-extinguishing agent from the fire-extinguishing agent inlet 33 of the drum can 30 at once.

[0034] Such a fire extinction experiment was carried out for the comparative fire-extinguishing agent 1 and the comparative fire-extinguishing agent 2; and for the fire-extinguishing agent 11 and the fire-extinguishing agent 12, the fire extinction experiment was carried out by changing the mixing amount of the ceramic beads CB.

[0035] The fire extinction experiment for each of the fire-extinguishing agents was carried out three times; and a fire-extinguishing agent which could extinguish the fire in three times all was evaluated as "being able to extinguish fire (passing)"; and a fire-extinguishing agent which could not extinguish a fire in any one time was evaluated as "being unable to extinguish fire (failure)".

[0036] Table 1 collectively shows the result of the fire extinction experiment of the comparative fire-extinguishing agent 1 composed only of the mixed chemical liquid 21 and the result of the fire extinction experiment of the fire-extinguishing agent 11 prepared by mixing the ceramic beads CB in the mixed chemical liquid 21. Table

2 collectively shows the result of the fire extinction experiment of the comparative fire-extinguishing agent 2 composed only of the mixed chemical liquid 22 and the result of the fire extinction experiment of the fire-extinguishing agent 12 prepared by mixing the ceramic beads CB in the mixed chemical liquid 22.

<Mixing amount of the ceramic beads>

[0037] In Tables 1 and 2, each value (w/q) obtained by dividing a weight w (unit: g) of the ceramic beads CB by a mixed chemical liquid amount q (volume in mL) is shown (a weight of the ceramic beads CB mixed with respect to a q mL of the mixed chemical liquid). Therefore, a value obtained by multiplying a w/q by 100 is the weight (unit: g) of the ceramic beads CB mixed with respect to 100 mL of the mixed chemical liquid.

[0038] A sample number is shown for each of the comparative fire-extinguishing agents and the fire-extinguishing agents together with the w/q in Tables 1 and 2; and in the column of passing or failure in fire extinction, a sample which could extinguish fire is mentioned as "passing", and a column for a sample which could not extinguish fire is made blank.

[0039] First, comparing the comparative fire-extinguishing agent 1 and the fire-extinguishing agent 11, both of which were based on the mixed chemical liquid 21 in common, the comparative fire-extinguishing agent 1 could not extinguish fire, even used in 1,000 mL (sample number: A04). Although the fire-extinguishing agent 11 in which the ceramic beads CB were mixed in 2.5 g/100 ml could extinguish fire when used in 800 mL (sample number: A14), it could not extinguish fire when used in 600 mL (sample number: A10).

[0040] From the above, the fire-extinguishing agent 11 can be said to have improved fire extinction effect by mixing the ceramic beads CB in 2.5 g/100 mL or more. For the fire extinction, however, the amount of the fire-extinguishing agent 11 needed can be considered to be 800 mL.

[Table 1]

#1	Fire-Extinguishing Agent
#2	Mixed Chemical Liquid
#3	Amount of Mixed Chemical Liquid (q)
#4	Ceramic Beads (w)
#5	Passing or Failure in Fire Extinction
#6	Sample Number
#7	Comparative Fire-Extinguishing Agent 1
#8	Mixed Chemical Liquid 21
#9	none
#10	Fire-Extinguishing Agent 11
#11	passing

[0041] Then, comparing the comparative fire-extinguishing agent 2 and the fire-extinguishing agent 12, both

of which were based on the mixed chemical liquid 22 in common, the comparative fire-extinguishing agent 2 could not extinguish fire even used in 800 mL thereof (sample number: B03). The fire-extinguishing agent 12 in which the ceramic beads CB were mixed in 1.25 g/100 ml could extinguish fire when used in 800 mL (sample number: B10). By contrast, the fire-extinguishing agent 12 in which the ceramic beads CB were mixed in 1.67 g/100 ml could not extinguish fire when used in 600 mL (sample number: B08).

[0042] From the above, the fire-extinguishing agent 12 can be said to have improved fire extinction effect by mixing the ceramic beads CB in 1.25 g/100 mL or more. For the fire extinction, however, the amount of the fire-extinguishing agent 12 needed can be considered to be 800 mL.

[Table 2]

#1	Fire-Extinguishing Agent
#2	Mixed Chemical Liquid
#3	Amount of Mixed Chemical Liquid (q)
#4	Ceramic Beads (w)
#5	Passing or Failure in Fire Extinction
#6	Sample Number
#7	Comparative Fire-Extinguishing Agent 2
#8	Mixed Chemical Liquid 22
#9	none
#10	passing
#11	Fire-Extinguishing Agent 12

[0043] From the above, it can be said to be preferable in the case where the mixed chemical liquid 21 alone is used as a base and the ceramic beads CB are mixed that the amount of the ceramic beads CB to be mixed with the mixed chemical liquid 21 is made to be 2.5 g/100 mL or more. It can be said to be preferable in the case where the ceramic beads CB are mixed in the mixed chemical liquid 22 that the amount of the ceramic beads CB to be mixed with the mixed chemical liquid 22 is made to be 1.25 g/100 mL or more. It can be said that the mixed chemical liquid 22 in which the fluorine-based foam fire-extinguishing agent is mixed with the mixed chemical liquid 21 more improves the fire extinction effect.

[0044] The fire-extinguishing agent according to the present invention is not limited to the above-mentioned ones, and suitable modifications and changes may be made without departing from their gist. For example, the inorganic salt aqueous solution is not limited to the above-mentioned constitution, and the fluorine-based foam fire-extinguishing agent also is not limited to the above-mentioned one.

[0045] Further the insoluble admixture may not be the above-mentioned ceramic beads CB, but may be a fibrous material or the like as long as the fire-extinguishing chemical liquid can infiltrate thereinto or can adhere to its surface, and has a small specific gravity and easily

floats on the liquid surface of petroleum and the like.

<Fire extinguisher>

[0046] A fire extinguisher 40 using the fire-extinguishing agent 11 or the fire-extinguishing agent 12 (those enhanced in the fire extinction effect by mixing a predetermined amount or more of the ceramic beads) is shown in Figure 2. The fire extinguisher 40 is one packed in its container 41 with, for example, 600 to 800 mL of the fire-extinguishing agent 11 (sample number: A14) or the fire-extinguishing agent 12 (sample number: B10).

[0047] The container 41 is formed, for example, of a synthetic resin, and took a nearly circular cylindrical shape having a diameter capable of being grasped with a hand of an adult, and has a middle portion in the axial direction of the circular cylinder having a diameter slightly smaller than the other region. Reference numeral 42 in Figure 2 is a packing part to pack a fire-extinguishing agent.

[0048] When the fire extinguisher 40 is thrown in fire, since the container 41 melts by heat of flames, or is broken by collision with a burning material, the packed fire-extinguishing agent 11 or fire-extinguishing agent 12 scatters in the fire, and diffuses to a surface of the burning material (in petroleum fires, it scatters on a liquid surface of petroleum, and in fires of buildings, on their structural bodies and the like). As a result, the fire is quickly extinguished.

<Built-in fire extinguisher>

[0049] Figure 3 is a view illustrating a schematic structure in the case where a fire extinguisher 43 is disposed on a door frame body 50. The door frame body 50 has an upper frame 51, a lower frame 52, a first longitudinal frame 53 and a second longitudinal frame 54, and takes a rectangular shape; and a door (not shown in figure) can be installed on the inner side of the door frame body 50. The upper frame 51, the lower frame 52, the first longitudinal frame 53 and the second longitudinal frame 54 are constituted, for example, of a channel material, a hollow material; in the channel part, the hollow part or the like, the fire extinguisher 43 having a plurality of containers 44i (i = 1, 2, ..., n) is built. The containers 44i are packed with the fire-extinguishing agent 11 or the fire-extinguishing agent 12 as in the fire extinguisher 40. The fire extinguisher 43 can be disposed other than on the door frame body, for example, on at least a part of a beam, an interior material or an exterior material of a building.

[0050] If the fire extinguisher 43 is disposed in such a manner, when a fire occurs indoor, since the plurality of containers 44i melt or otherwise by heat of flames, the packed fire-extinguishing agent 11 or fire-extinguishing agent 12 scatters in the fire and can quickly extinguish the fire. Further since the containers 44i melt or otherwise by heat of flames, the automatic fire extinction can be

accomplished. If the fire extinguisher 43 is disposed, for example, on frame bodies and/or beams of a cooking place, a storehouse accommodating combustible materials, or the like, when a fire occurs, the quick fire extinction at the origin of the fire is enabled to be made. Of course, the fire extinguisher may be one whose containers 44i are broken or otherwise based on a signal of a fire detector (not shown in figure).

<Peripherally arranged fire extinguisher>

[0051] Figure 4 is a view illustrating a schematic structure of a fire extinguisher 45 disposed so as to surround a petroleum tank 61 installed on a seashore 60. The fire extinguisher 45 has a plurality of containers 46i (i = 1, 2, ..., n), and the containers 46i are packed with the fire-extinguishing agent 11 or the fire-extinguishing agent 12 as in the fire extinguisher 40. Also on land, a plurality of containers 46 are similarly disposed so as to surround the petroleum tank 61, but the description is omitted in Figure 4.

[0052] When petroleum stored in the petroleum tank 61 flows out to a circumference of the petroleum tank 61 due to a disaster or the like, and catches fire to thereby cause a fire, since the containers 46i melt or otherwise by heat of flames, the fire-extinguishing agent 11 or 12 diffuses and the fire can be extinguished quickly. Further since the containers 46i melt or otherwise by heat of flames, the automatic fire extinction can be accomplished. Of course, the fire extinguisher may be one whose containers 46i are broken or otherwise based on a signal of a fire detector (not shown in figure).

[0053] Here, the fire extinguisher 45 may be one disposed on an oil fence to protect the diffusion of petroleum having flowed out from the petroleum tank 61. For example, in the case where a disaster such as an earthquake occurs, the fire-extinguishing agent 11 or 12 is previously diffused to a circumference of the petroleum tank 61 by detecting the earthquake and breaking the containers 46i; then even if petroleum flows out, the occurrence of a fire can be prevented.

[0054] Of course, the fire extinguisher 45 can be disposed so as to surround tanks and the like (including tankers loading petroleum and the like) to store petroleum on the sea, and the fire extinguisher 43 may also be disposed on structural bodies of the petroleum tank 61. The fire extinguisher 45 may further be disposed so as to surround a circumference of a building such as a storehouse (not shown in figure).

[0055] Then, the fire-extinguishing agent and the fire extinguisher according to the present invention are not limited to the above-mentioned Examples, and suitable modifications and changes may be made without departing from their gist. For example, the insoluble admixture suffices as long as being prevented from sinking due to the viscosity of a liquid, or having a low bulk specific gravity and being able to stay in the vicinity of a liquid surface for a long time, and suffices if the fire-extinguishing chem-

ical liquid can be absorbed in it or can adhere to its surface, and it has a flame retardancy in such a degree that the insoluble admixture does not burn at least during the chemical reaction of the fire-extinguishing chemical liquid on being thrown in flames. Therefore, the insoluble admixture is not limited to ceramic beads, and may be a ceramic filler, active carbon, perlite, ligneous fiber, pulp, nonwoven fabric or material formed of another material.

Industrial Applicability

[0056] Since the fire-extinguishing agent and the fire extinguisher according to the present invention can be industrially produced and commercially sold and otherwise, the present invention is an invention having an economical value and industrial applicability.

Reference Signs List

- [0057]**
- 11, 12 FIRE-EXTINGUISHING AGENT
 - 21, 22 FIRE-EXTINGUISHING CHEMICAL LIQUID (MIXED CHEMICAL LIQUID)
 - 40, 43, 45 FIRE EXTINGUISHER
 - 41, 44i, 46i CONTAINER
 - 50 STRUCTURAL BODY (DOOR FRAME BODY)
 - CB INSOLUBLE ADMIXTURE (CERAMIC BEADS)

Claims

1. A fire-extinguishing agent, comprising: at least, a fire-extinguishing chemical liquid; and an insoluble admixture into which the fire-extinguishing chemical liquid can infiltrate and/or to which the fire-extinguishing chemical liquid can adhere following mixed with the fire-extinguishing chemical liquid, and which takes at least one of a fibrous form, a porous form and a powdery form.
2. The fire-extinguishing agent according to claim 1, wherein the insoluble admixture comprises at least one of ceramic beads, ceramic fillers, active carbon, perlite, ligneous fibers, pulps and nonwoven fabrics.
3. The fire-extinguishing agent according to claim 1, wherein the fire-extinguishing chemical liquid is:
 - an inorganic salt aqueous solution which generates carbon dioxide gas or ammonia gas upon thermal decomposition; or
 - a mixed chemical liquid of the inorganic salt aqueous solution and a foam fire-extinguishing chemical liquid.
4. The fire-extinguishing agent according to claim 3, wherein the insoluble admixture is:

- mixed in an amount of 2.5 g or more with respect to 100 mL of the fire-extinguishing chemical liquid when the fire-extinguishing chemical liquid is the inorganic salt aqueous solution alone; or mixed in an amount of 1.25 g or more with respect to 100 mL of the fire-extinguishing chemical liquid when the fire-extinguishing chemical liquid is the mixed chemical liquid of the inorganic salt aqueous solution and the foam fire-extinguishing chemical liquid.
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5. A fire extinguisher comprising a container containing the fire-extinguishing agent according to claim 4, wherein the fire-extinguishing agent is diffused by breaking or melting of the container.
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6. A fire extinguisher comprising a container containing the fire-extinguishing agent according to claim 4, wherein the container takes a shape capable of being grasped, and the fire-extinguishing agent is diffused to a surface of burning materials when the container is thrown in fire and breaks or melts.
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7. A fire extinguisher comprising a container containing the fire-extinguishing agent according to claim 4, wherein the container is disposed on at least a part of a structural body, an interior material and an exterior material of a building, and the fire-extinguishing agent is diffused when the container breaks or melts by fire or the container is artificially broken.
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8. A fire extinguisher comprising a container containing the fire-extinguishing agent according to claim 4, wherein the container is disposed on a circumference of a structure; and the fire-extinguishing agent is diffused when the container breaks or melts by fire of the structure or the container is artificially broken.
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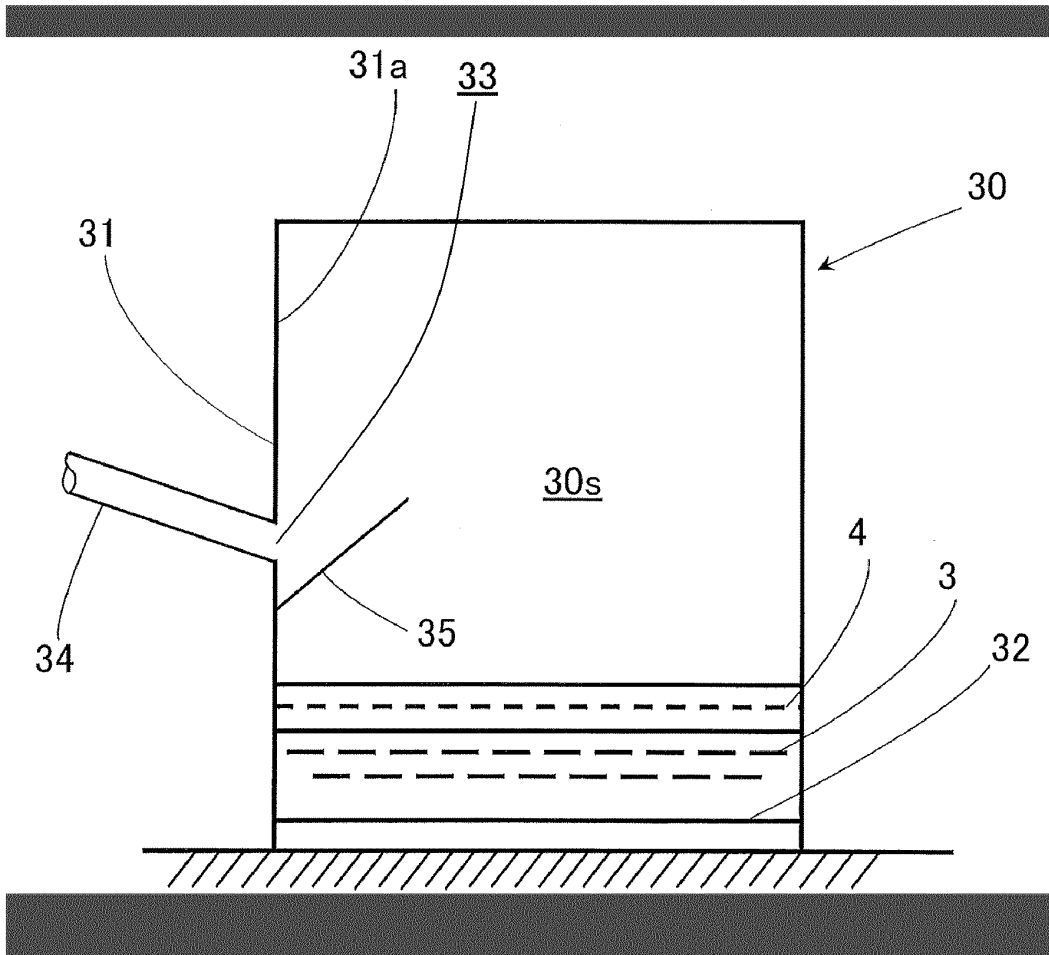


FIG.1

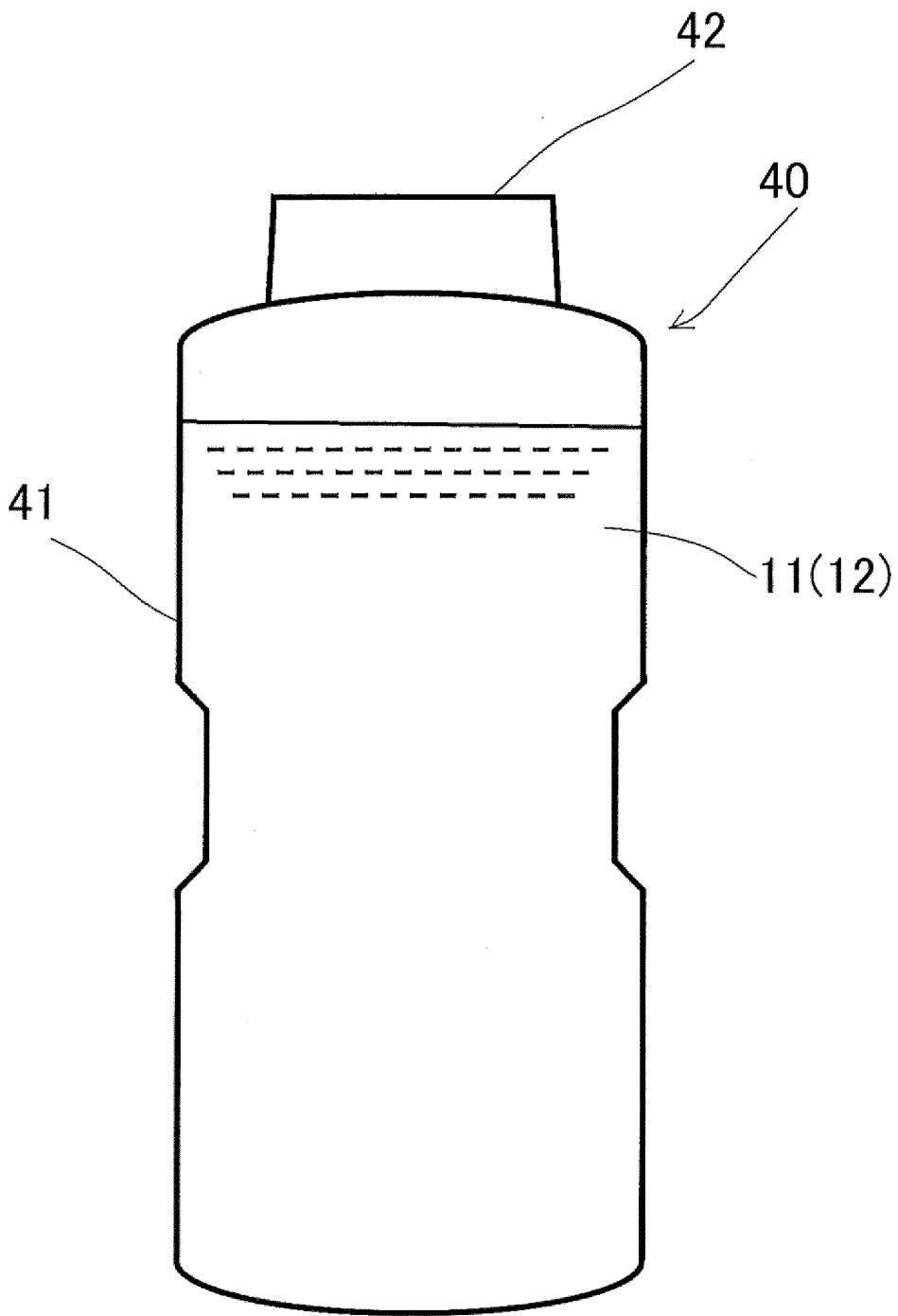


FIG.2

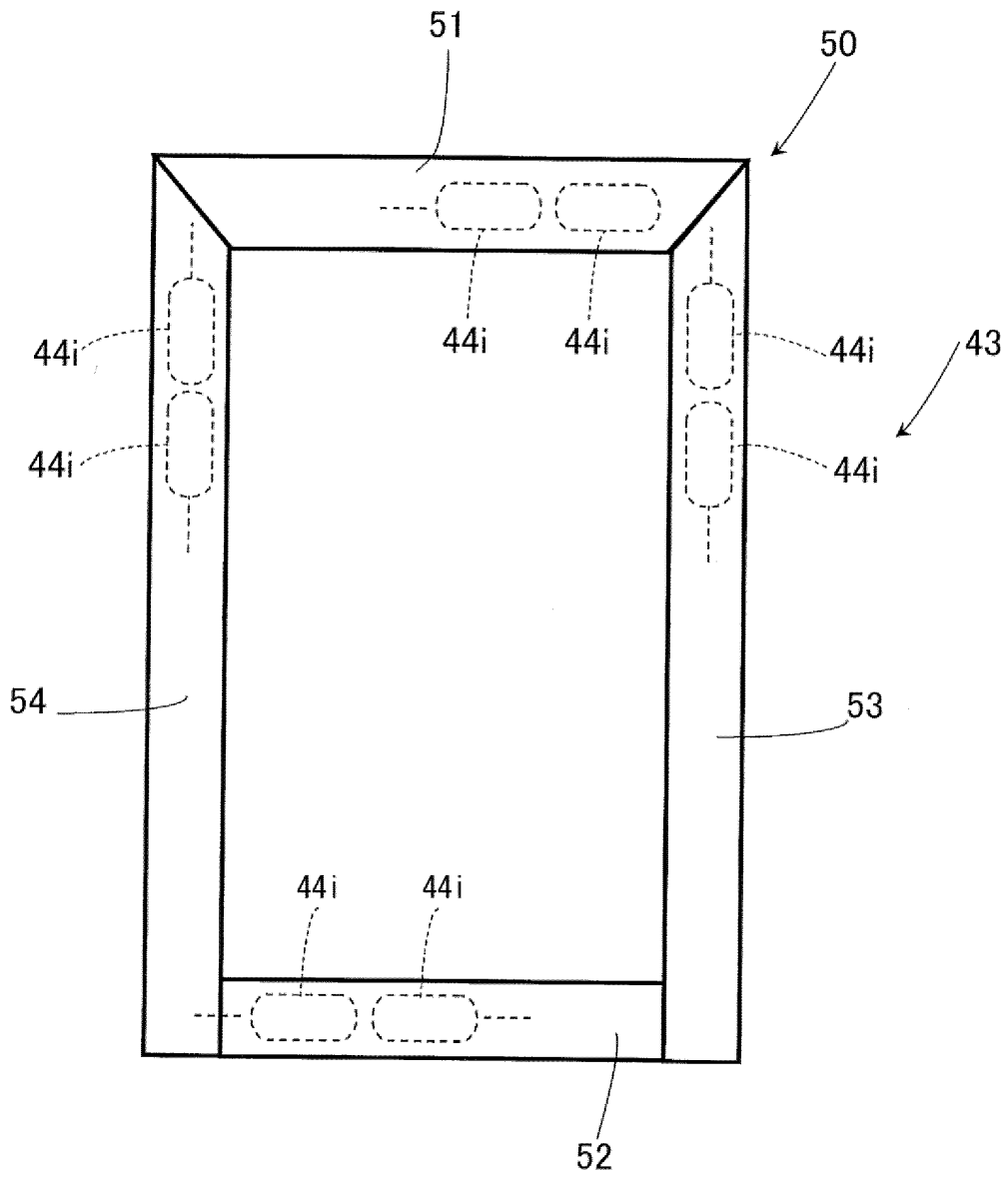


FIG.3

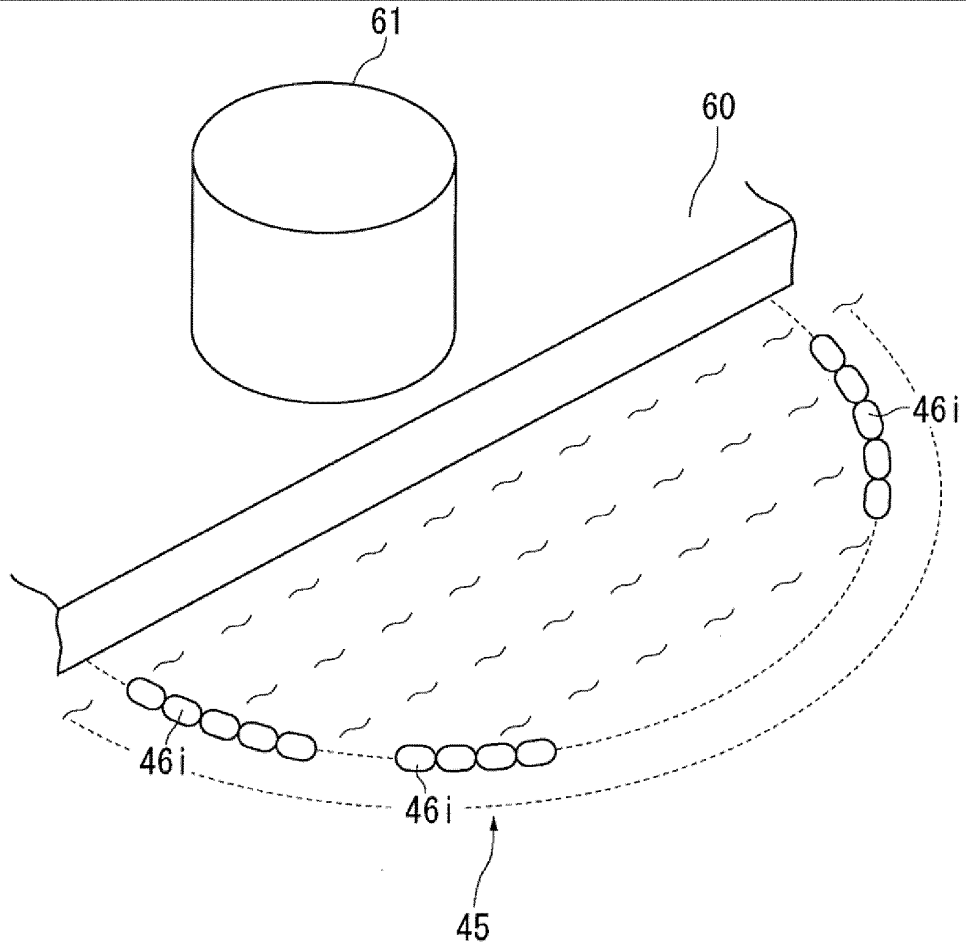


FIG.4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/068762

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A. CLASSIFICATION OF SUBJECT MATTER A62D1/06(2006.01) i		
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) A62D1/06		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2012 Kokai Jitsuyo Shinan Koho 1971-2012 Toroku Jitsuyo Shinan Koho 1994-2012		
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 Y	JP 2009-509627 A (Thermos A/S), 12 March 2009 (12.03.2009), claims 1 to 4, 8; paragraphs [0016] to [0017], [0021] & US 2008/0251752 A1 & EP 1940521 A1 & WO 2007/043888 A1	1-5 6-8
Y	JP 9-253231 A (Ebisu Science Laboratory Inc.), 30 September 1997 (30.09.1997), claim 1 & US 5778984 A	6-8
Y	JP 2010-17491 A (ST Planning Kabushiki Kaisha), 28 January 2010 (28.01.2010), claims 1 to 5 (Family: none)	6-8
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> 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 "E" earlier application or patent but published on or after the international filing date "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) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "I" 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 "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 "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 "&" document member of the same patent family		
Date of the actual completion of the international search 16 October, 2012 (16.10.12)		Date of mailing of the international search report 30 October, 2012 (30.10.12)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

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REFERENCES CITED IN THE DESCRIPTION

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