

[54] MARINE VESSEL FIRE EXTINGUISHER

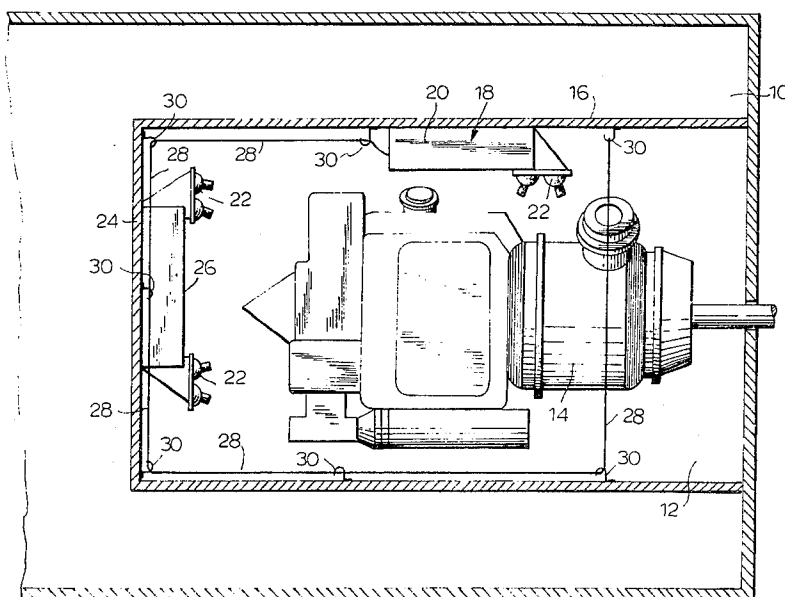
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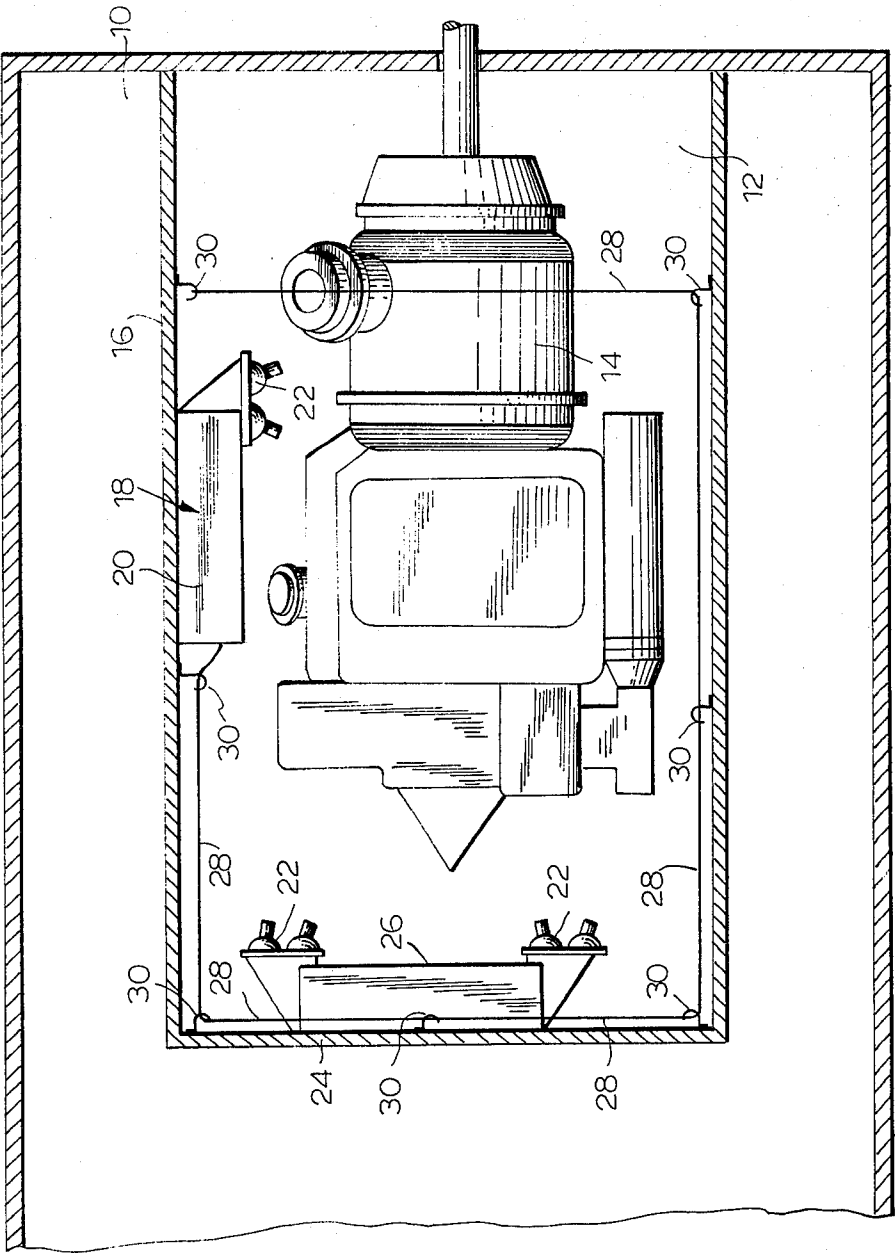
[76] Inventor: **Byron G. Dunn**, 6831 Orchid Ln.,
Dallas, Tex. 75230*Primary Examiner*—Lloyd L. King*Assistant Examiner*—Michael Mar[22] Filed: **Nov. 19, 1973***Attorney, Agent, or Firm*—Charles F. Steininger[21] Appl. No.: **417,080****Related U.S. Application Data**[63] Continuation-in-part of Ser. Nos. 131,333, April 5,
1971, Pat. No. 3,773,111, and Ser. No. 400,623,
Sept. 25, 1973, and Ser. No. 400,640, Sept. 25, 1973.[52] U.S. Cl. **169/59; 169/62; 169/26;**
169/33[51] Int. Cl. **A62c 35/02**[58] Field of Search 169/26, 62, 5, 9, 46, 28,
169/77, 59[56] **References Cited****UNITED STATES PATENTS**

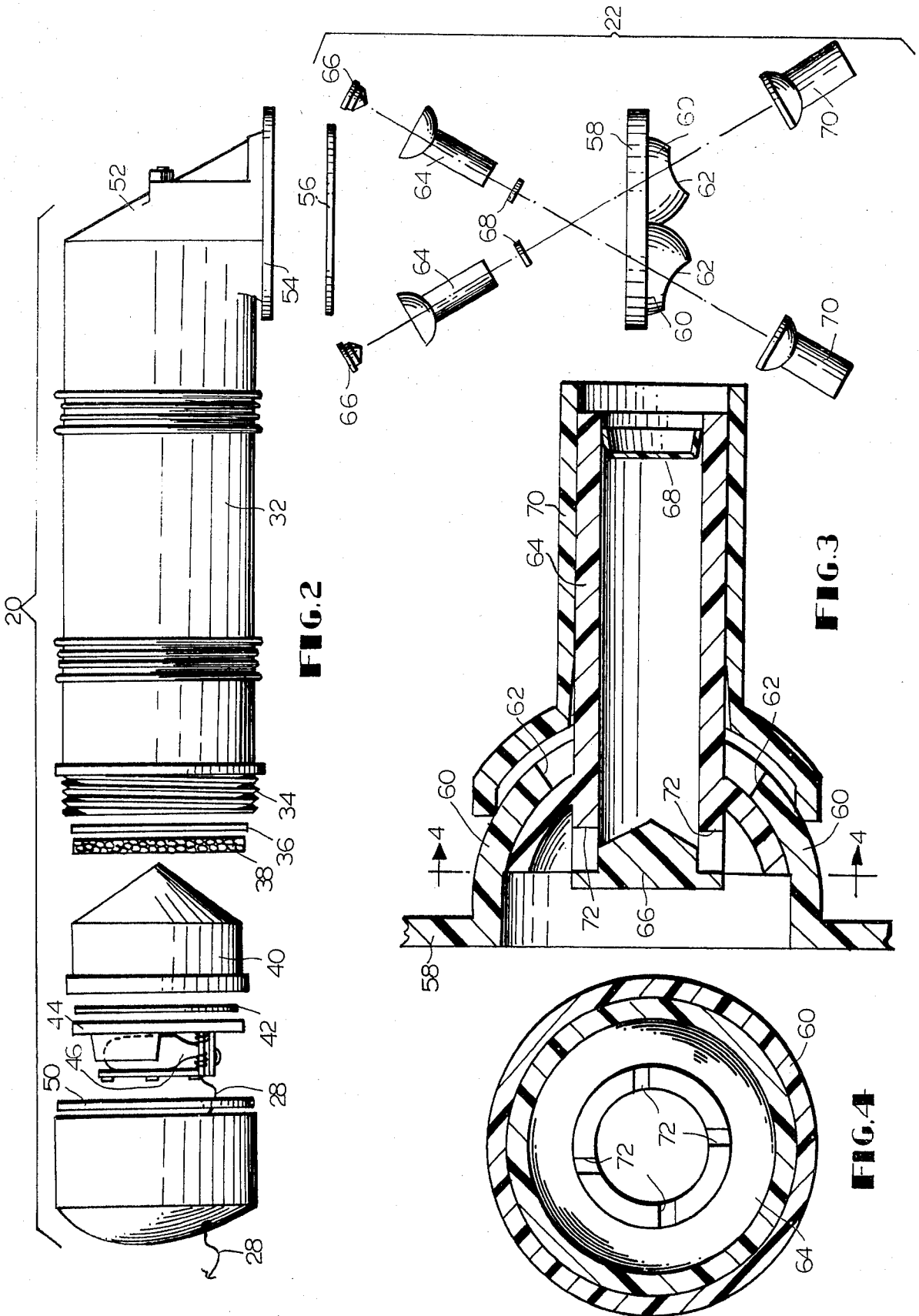
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[57] **ABSTRACT**

A fire extinguishing system for use in a confined, enclosed compartment of a marine vessel, particularly an engine compartment, in which a generally-tubular container, filled with a synergistic mixture of an alkali metal or alkaline earth metal carbonate or bicarbonate and a synthetic metal silicate, is mounted in the compartment, a dispersing means is mounted on one or both ends of the container, a propellant means, preferably including a gas impervious piston, a container of a pressurized gas and a spring-loaded puncturing means, is mounted in the container and a flame-actuated ignition means, preferably composed of specific amounts of platinum or palladium in intimate contact with aluminum or magnesium, is operatively attached to the propellant means and disposed about the interior of the compartment.

7 Claims, 7 Drawing Figures





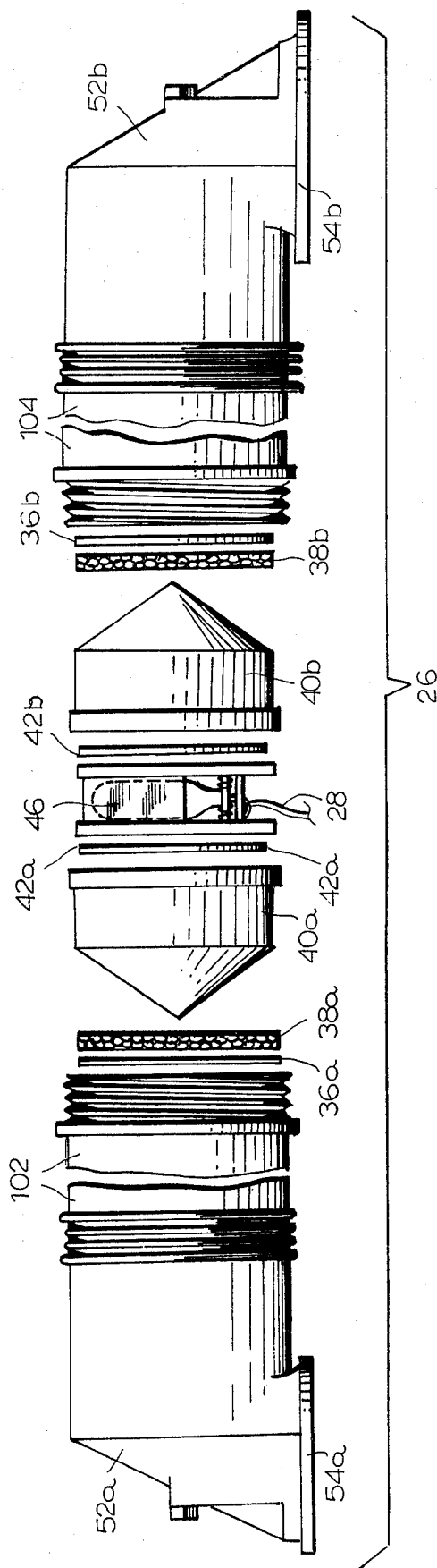


FIG. 7

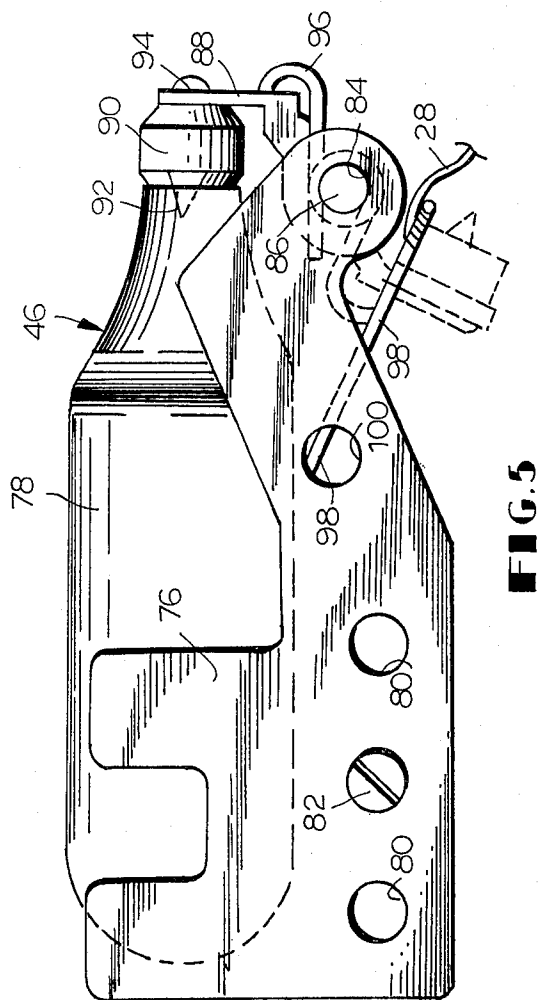


FIG. 5

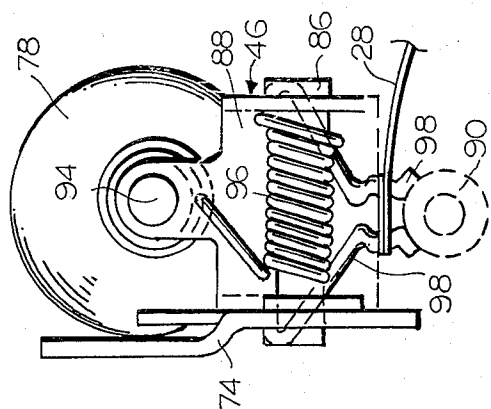


FIG. 6

MARINE VESSEL FIRE EXTINGUISHER

REFERENCES TO RELATED APPLICATIONS

The present application is a continuation-in-part of applications Ser. No. 131,333, filed Apr. 5, 1971 now U.S. Pat. No. 3,773,111; Ser. No. 400,623 filed Sept. 25, 1973 and Ser. No. 400,640, filed Sept. 25, 1973, all by the present inventor. These prior applications are incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention relates to a fire detection and extinguishing system for confined, enclosed areas of marine vessels. More specifically, the present invention relates to a fire detection and extinguishing system for confined, enclosed areas of marine vessels, particularly engine compartments, paint lockers, etc.

Below deck compartments, paint lockers and engine rooms or compartments of marine vessels have long been hazardous fire sources to the mariner and boat owner or operator. Fires in these areas have often grown to hazardous conflagrations before detection. This, of course, makes the task of fire fighting more hazardous and a substantial risk to the life and body of the occupants. In many cases, it makes it necessary to abandon the vessel rather than attempt to fight the fire. A number of systems have been proposed to detect and extinguish fires, particularly the engine compartments of marine vessels. However, such systems have generally failed to provide devices which are fail-safe and capable of detecting and extinguishing an incipient fire before it becomes a major conflagration. For example, it has been proposed to provide extinguishing systems with a fusible link to actuate the system and release the extinguishing agent. However, such fusible links and other fusible elements are subject to a number of drawbacks. First of all, the fusible elements are relatively unreliable due to the fact that they become coated with dirt, grease and the like, which act as an insulator thereby raising the temperature at which actuation occurs. Further, such fusible link mechanisms often actuate prematurely or accidentally as a result of a combination of the heat of the engine together with heat from the sun on the engine compartment. Finally, such mechanisms require numerous individual elements placed at strategic locations and will fail unless more than one unit is used. However, in most cases, one unit is used and is actuated only if the fire is in the exact vicinity of the fusible element.

Such systems have also included a wide variety of extinguishing agents. Carbon dioxide systems, of course, require bulky containers which are under pressure and such pressurized, large containers are in and of themselves a hazard in many cases. Further, they require substantial space either in the compartment or some other location in the boat. Liquid extinguishing materials, such as bromotrifluoromethane, which is a liquid under pressure in a container but when mixed with air and under reduced pressure becomes a gas, and other halogenated methanes have also been used. However, such pressurized containers are a danger in themselves. Further, nozzles, etc., necessary for the deployment of such liquid materials are subject to becoming corroded or plugged under marine conditions of use, thereby rendering the entire system inoperable. Finally, such liquid extinguishing materials, particularly the halogenated methanes, are toxic and therefore not well suited

to use where human beings will come into contact with the residue. This, of course, also requires substantial clean-up after the system is actuated.

It is therefore an object of the present invention to provide a system for the detection and extinguishment of incipient fires in confined marine spaces, such as engine compartments. Another object of the present invention is to provide a system for the detection and extinguishment of fires in confined spaces of marine vessels wherein an incipient fire is detected and extinguished in a matter of seconds. A still further object of the present invention is to provide a system for detection and extinguishment of incipient fires in confined marine compartments which is actuatable by a flame and not by heat alone. Another and further object of the present invention is to provide a system for detecting and extinguishing incipient fires in confined marine vessel enclosures which will withstand the adverse conditions faces in confined compartments of marine vessels. Yet another object of the present invention is to provide a system for detecting and extinguishing incipient fires in confined enclosures of marine vessels wherein complete coverage of such enclosure is attained. A still further object of the present invention is to provide a system for detecting and extinguishing incipient fires in enclosed compartments of marine vessels wherein relatively simple cleanup is possible after actuation of the system.

SUMMARY OF THE INVENTION

A fire extinguishing system for use in confined, enclosed compartments of marine vessels, comprising, at least one extinguishing unit, including a container mounted inside the compartment and adapted to hold a solid, powderform fire extinguishing agent, distributing means operatively mounted on the container and adapted to distribute the extinguishing agent throughout the compartment and propellant means within the container and adapted to generate a gas pressure on the extinguishing agent sufficient to force the extinguishing agent through the distributing means, and a flame-responsive ignition means operatively connected to the propellant means adapted to actuate the propellant means and generate gas pressure, resistant to spontaneous ignition temperatures normally encountered in the compartment and disposed about the compartment.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view, partially in section, of the fire extinguishing system of the present invention mounted in the engine compartment of a marine vessel;

FIG. 2 is an exploded view of a cannister and nozzle assembly for use in the extinguishing system of FIG. 1;

FIG. 3 is a cross-sectional view of an assembled nozzle for the nozzle assembly of FIG. 2;

FIG. 4 is a cross-sectional view along the line 4—4 of FIG. 3;

FIG. 5 is a side view of a propellant and actuator assembly for the extinguisher of FIG. 2;

FIG. 6 is a top view of the propellant and actuator assembly of FIG. 5; and

FIG. 7 is an exploded view of a modified cannister assembly for the fire extinguishing system of FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 of the drawings shows a marine vessel 10 having an engine compartment 12 and an engine 14.

Mounted on one sidewall 16 is an extinguisher 18, comprising, a cannister assembly 20 and a nozzle assembly 22. Mounted on end wall 24 is an extinguisher 18 having a modified cannister assembly 26 and a pair of nozzle assemblies 22. The cannisters 18 may be used in any number or utilize any combinations of cannister assemblies 20 and 26 depending upon the size of the compartment and the desired coverage of fire extinguishing agent to be attained. Leading from one end of cannister assembly 20 to the middle of cannister assembly 26 and thence across the compartment 12 is an ignition line 28. Ignition line 28 is held in place by hooks or hangers 30. Ignition line 28 may be disposed in any configuration about compartment 12 in order to be in position where a flame in any part of the compartment will strike the line and actuate the system. Where more than one extinguisher 18 is utilized, the system can be arranged in modular units, a nozzle assembly 22 being trained to cover a specific area of the compartment and the ignition line from that particular extinguisher being deployed in that area only while other extinguishers and their individual ignition lines cover other areas. As previously indicated, the system of the present invention may be utilized in any confined, enclosed compartment of a marine vessel, such as, engine compartments, paint lockers, etc.

FIG. 2 of the drawings shows an exploded view of the cannister assembly 20 and the nozzle assembly 22 of the fire extinguishing system of the present application. In FIG. 2, a main tubular body portion 32 is provided. Body portion 32 is threaded at its rear end portion 34. Mounted inside tubular body 32, adjacent the front end thereof and resting against a reduced shoulder therein, is frangible disc 36. The tubular body 32 is packed with a dry chemical fire extinguishing agent 38 (hereinafter referred to in greater detail). Thereafter, a piston assembly 40 is positioned in tubular body 32. The rear end of tubular body portion 32 is then closed by means of frangible disc 42 mounted on actuator plate 44. Actuator plate 44 has mounted thereon actuator assembly 46. Actuator plate 44 rests on a shoulder in end cap assembly 48. Cap 48 is screwed on portion 34 of tubular body 32 and sealed by means of O-ring 50. The front end of tubular body 32 is closed by an integrally-formed, deflector head portion 52. Head portion 52 directs the extinguishing material 38 downwardly where it exits through mounting head 54. Mounted within an annular groove in mounting head 54 is O-ring 56 which forms a part of nozzle assembly 22. Nozzle assembly 22 includes nozzles base 58 which mounts on mounting head 54. Nozzle base 58 has hemispherical nozzle supports 60 provided with angularly-disposed apertures 62. Passing through apertures 62 are distributing nozzles 64. Distributing nozzles 64 have mounted in their upper ends nozzle deflectors 66 and in their lower ends temporary nozzle seals 68. The free ends of distributing nozzles 64, which pass through apertures 62, have slidably mounted on the outside thereof nozzle retainers 70. Nozzle retainers 70 are press-fit on nozzles 64 in a manner such that nozzles 64 and nozzle retainers 70 are freely movable over a wide angular range about hemispherical supports 60.

FIGS. 3 and 4 of the drawings show the nozzle assembly 22 (FIG. 2) in its assembled condition. The assembly, of course, includes nozzle base 58 having hemispherical projections 60 with apertures 62 formed therein. Passing into and through the apertures 62 is

distributing nozzle 64. Distributing nozzle 64 has temporary end cap 68 mounted in one end thereof and nozzle deflector 66 mounted in the opposite end. Distributing nozzle 64 is also provided at its upper end with angularly disposed apertures 72. When pressure is applied to the dry extinguishing agent 38 (FIG. 2) in body 32 of the cannister assembly, the pressurized extinguishing powder is forced outwardly through apertures 72 and the interior of nozzle 64 and this pressure blows cap 68 out the end of nozzle 64. Otherwise, cap 68 provides a seal to prevent grease moisture and the like from entering the nozzle assembly. Apertures 72 also serve a very distinct purpose. As will be seen from FIGS. 3 and 4, apertures 72 are disposed parallel to the radii of nozzle 64 and offset therefrom. By this placement, the powdered fire extinguishing agent exits through nozzle 64 in a swirling or a vortical motion due to the coaction of and placement of the apertures 72 with respect to deflector 66. This has a critical effect on the distribution of the powdered extinguishing agent over the area to be protected.

FIGS. 5 and 6 show the actuator assembly 46 in detail. Actuator assembly 46 is held in place by actuator bracket 74. Actuator bracket 74 is provided with a flange portion 76 which extends over and holds pressurized gas bottle 78 in place. Actuator bracket 74 is provided with apertures 80 which fit on posts of actuator plate 44. Passing through a central aperture between the posts is a screw 82 which passes into an aperture of plate 44 to hold actuator bracket 74 in place. Actuator bracket 74 is provided with an aperture 84 which cooperates with an aperture in plate 44 to receive pivot pin 86 of the actuator assembly. Mounted on pivot pin 86 is hammer bracket 88. Hammer bracket 88 carries hammer 90 with puncturing pin 92. The puncturing pin 92 is so aligned that it will puncture the seal of gas bottle 78 at an appropriate time. Hammer 90 is manufactured as a separate entity from hammer bracket 88 and is attached thereto by swaging a central post 94. Pivot pin 86 also carries helical, power spring 96 which has one end thereof resting on top of hammer bracket 88 and the other end thereof resting against a post of support plate 44. The solid line outline of hammer bracket 88, hammer 90 and spring 96 show the active or released position of these elements. Shown in dashed lines is the cocked or inactive position of hammer bracket 88, hammer 90 and spring 96. Hammer bracket 88 is held in the cocked position by means of clip 98. Clip 98 is held in place by having two side extensions thereof pass into aperture 100 in the actuator bracket 74 and an aperture of plate 44. Clip 98 is therefore free to rotate or pivot to a limited extent making it possible to align the clip with hammer bracket 88. However, bracket 88 is thereby held in the cocked position by gripping the same between the legs of clip 98 and then wrapping sensor 28 about the free ends of the clip. Thus, it is obvious that the actuator, once cocked, will operate as follows: The sensor 28 will burn, releasing the tension on clip 98. Clip 98 will thereby release hammer bracket 88 which is driven by power spring 96. In the extreme, hammer bracket 88 will assume the position shown in solid lines with the hammer 90 against the end of gas bottle 78 and the puncturing pin through the seal of gas bottle 78.

FIG. 7 of the drawings is an exploded view of modified cannister assembly 26. The two ends of cannister assembly are mirror images of one another. The only

difference between cannister assembly 26 and cannister assembly 20 (FIG. 2) is that the cannister body is divided into two sections 102 and 104 and a single actuator assembly 46 serves to pressurize both sections 102 and 104. Actuator assembly 46 may be mounted in a collar (not shown) which is internally threaded to receive sections 102 and 104. Parts corresponding to those in FIG. 2 are numbered in the same manner except for using the designations *a* and *b* to represent the parts of sections 102 and 104, respectively. Nozzle assemblies 22 of FIG. 3 fit on sections 102 and 104 of FIG. 7.

The cannister assembly and the nozzle assembly are preferably made of a material having a high degree of toughness, impact strength, heat resistance, dimensional stability and good electrical properties. While there are a number of materials which can be utilized, the preferred material is "Lexan 101" manufactured by the General Electric Company. This material is a thermoplastic polycarbonate resin suitable for use in molded or extruded structures and exhibits all of the properties specified above.

The sensor should be selected on the basis of the conditions to which it is subjected. The primary requisite is that the sensor should not be spontaneously ignited by heat alone but will be ignited and burn rapidly when a flame strikes it. A desirable sensor wire is one having about 80 to 20 parts by volume of a noble metal, such as, platinum or palladium, and about 20 to 80 parts by volume of another metal, such as, magnesium or aluminum. A particularly preferred material is a wire-type fuse known as PYROFUZE, manufactured by Pyrofuze Co. of Mount Vernon, N.Y. This sensor wire is a coaxially braided material having an aluminum core and a palladium shell. Platinum may also be used as the shell material. The wire normally will not ignite or burn at radiant heat temperatures as high as 1,200°F but will ignite instantaneously and burn rapidly, at a rate of about 0.9 foot per second, when contacted by a flame.

The frangible discs utilized in accordance with the present invention are a laminate of paper-polyethylene-aluminum foil-polyvinyl.

The nozzle seals are preferably of molded plastic lined with a laminate of paper and aluminum foil.

The pressurized gas bottle is preferably a bottle containing liquified CO₂. A suitable CO₂ cartridge is the type manufactured for "Mae West" life jackets. This component is designated by the U.S. Military as MIL-C-601B, Type I.

A critical component of the system of the present application is the dry, chemical fire extinguishing agent. Such an extinguishing agent must meet a number of very stringent requirements. First of all, it must be capable of extinguishing a Class B fire, which is a fire occurring in oils, greases, flammable liquids, etc. In extinguishing such fires, it is necessary that the extinguishing agent have a blanketing or smothering effect. The fire extinguishing agent of the present system meets and exceeds all of these requirements. The fire extinguishing agent of the present invention is a synergistic mixture of about 50 to 95% by weight of an alkali metal carbonate, an alkaline earth metal carbonate, an alkali metal bicarbonate or an alkaline earth metal bicarbonate and about 50 to 5% by weight of a metal silicate. Because of its availability, effectiveness and freedom from toxicity, the preferred carbonate is sodium bicarbonate. Preferably, the sodium bicarbonate is present in

amounts between 85 and 60% by weight of the composition. Specifically, the most desirable composition contains about 78% to 80% by weight of sodium bicarbonate. The metal silicate is preferably a nontoxic alkali metal or alkaline earth metal silicate and of a substantially pure character, such as, a material manufactured by precipitation. A highly effective silicate for use in accordance with the present invention is "Silene L," manufactured by Pittsburgh Plate Glass Company, Pittsburgh, Pa. This material is a precipitated calcium silicate and has an approximate analysis of CaO 19% and SiO₂ 57%; and a loss on ignition of about 14%. It has a specific gravity of about 2.1 and bulk density of about 15 to 16 pounds per cubic foot. The preferred range of silicate is in the amount of 15 to 40% by weight and, specifically, the most effective has been found to be about 19% to 20% by weight. The composition may also include minor amounts of, up to about 5% by weight of conventional desiccants, lubricants, adsorbents and the like. Suitable materials of this character include calcium chloride, diatomaceous earth, silica gel, calcium stearate, etc. and preferably are present in an amount of about 3%. Calcium stearate is a preferred desiccant. However, this last component is not necessary to the synergistic effect of the mixture of the present invention nor to its free-flowing properties. It has been found in accordance with the present invention that the mixture of bicarbonate and silicate has free-flowing characteristics making its discharge from a suitable extinguishing apparatus superior to most conventional extinguishing agents. It also resists stratification in storage and in the extinguishing apparatus. The mixture is also capable of withstanding extreme temperatures without deterioration, thereby providing long shelf life and useful life without recharging or replacement and is relatively resistant to moisture deterioration. Finally, the composition not only extinguishes the fire in a matter of seconds but also prevents reignition or flashback. The dry, chemical fire extinguishing agent of the present invention is packed in the body of the cannister between the frangible discs by vibration of the cannister and is the only known dry, chemical extinguishing agent which can be loaded in this manner.

While specific examples and structures have been described and illustrated herein, it is to be understood that modifications thereof will be obvious to one skilled in the art. Accordingly, the present invention is to be limited only in accordance with the appended claims.

I claim:

1. A fire extinguishing system for use in a confined, enclosed compartment of a marine vessel, comprising, at least one fire extinguishing unit, including a generally-cylindrical container mounted in said compartment, a solid, powder-form fire extinguishing agent disposed in said container, dispersing means operatively mounted on said container to distribute said extinguishing agent throughout said compartment, propellant means in said container adapted to generate a gas pressure sufficient to force said extinguishing agent through said distributing means and including gas-impermeable piston means mounted adjacent said extinguishing agent and in gas-tight relation with the walls of said container and flame-responsive ignition means resistant to ignition by heat generated in said compartment, operatively connected to said propellant means to actuate said propellant means and cause it to generate gas pressure and disposed about said compartment.

2. A system in accordance with claim 1 wherein the propellant means includes a container of a gas under pressure and puncturing means for puncturing said container.

3. A fire extinguishing system for use in a confined, enclosed compartment of a marine vessel, comprising, at least one fire extinguishing unit, including a container mounted in said compartment, a solid, powder-form fire extinguishing agent disposed in said container, dispersing means operatively mounted on each end of said container to distribute said extinguishing agent throughout said compartment, propellant means in said container adapted to generate a gas pressure sufficient to force said extinguishing agent through said distributing means, and flame-responsive ignition means resistant to ignition by heat generated in said compartment, operatively connected to said propellant means to actuate said propellant means and cause it to generate gas pressure and disposed about said compartment.

4. A fire extinguishing system for use in a confined, enclosed compartment of a marine vessel, comprising, at least one fire extinguishing unit, including a container mounted in said compartment, a solid, powder-form fire extinguishing agent disposed in said container comprising a metal carbonate selected from the group consisting of alkali metal carbonates, alkali metal bicarbonates, alkaline earth metal carbonates, alkaline earth metal bicarbonates and mixtures thereof, in a major amount of about 50 to 95% by weight, and a synthetic metal silicate, in a minor amount of about 5 to 5% by weight and sufficient to form an air-impermeable coating on the burning surface to which it is applied and prevent reignition of an extinguished

flame for at least 10 minutes, dispersing means operatively mounted on said compartment to distribute said extinguishing agent throughout said compartment, propellant means in said container adapted to generate a gas pressure sufficient to force said extinguishing agent through said distributing means, and flame-responsive ignition means resistant to ignition by heat generated in said compartment operatively connected to said propellant means to actuate said propellant means and cause it to generate gas pressure and disposed about said compartment.

5. A system in accordance with claim 4 wherein the compartment is an engine compartment.

6. A fire extinguishing system for use in a confined, enclosed compartment of a marine vessel, comprising, a container mounted in said compartment, a solid, powder-form fire extinguishing agent disposed in said container, dispersing means operatively mounted on said container to distribute said extinguishing agent throughout said compartment, propellant means in said container adapted to generate a gas pressure sufficient to force said extinguishing agent through said distributing means, and wire-type, flame-responsive ignition means resistant to ignition by heat generated in said compartment, operatively connected to said propellant means to actuate said propellant means and cause it to generate gas pressure and disposed about said cabinet and comprising 20 to 80% by volume of a metal selected from the group consisting of platinum and palladium and 80 to 20% by volume of a metal selected from the group consisting of aluminum and magnesium.

7. A system in accordance with claim 6 wherein the compartment is an engine compartment.

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