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AUTOMATIC FIRE EXTINGUISHING DEVICE

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Fig. 1

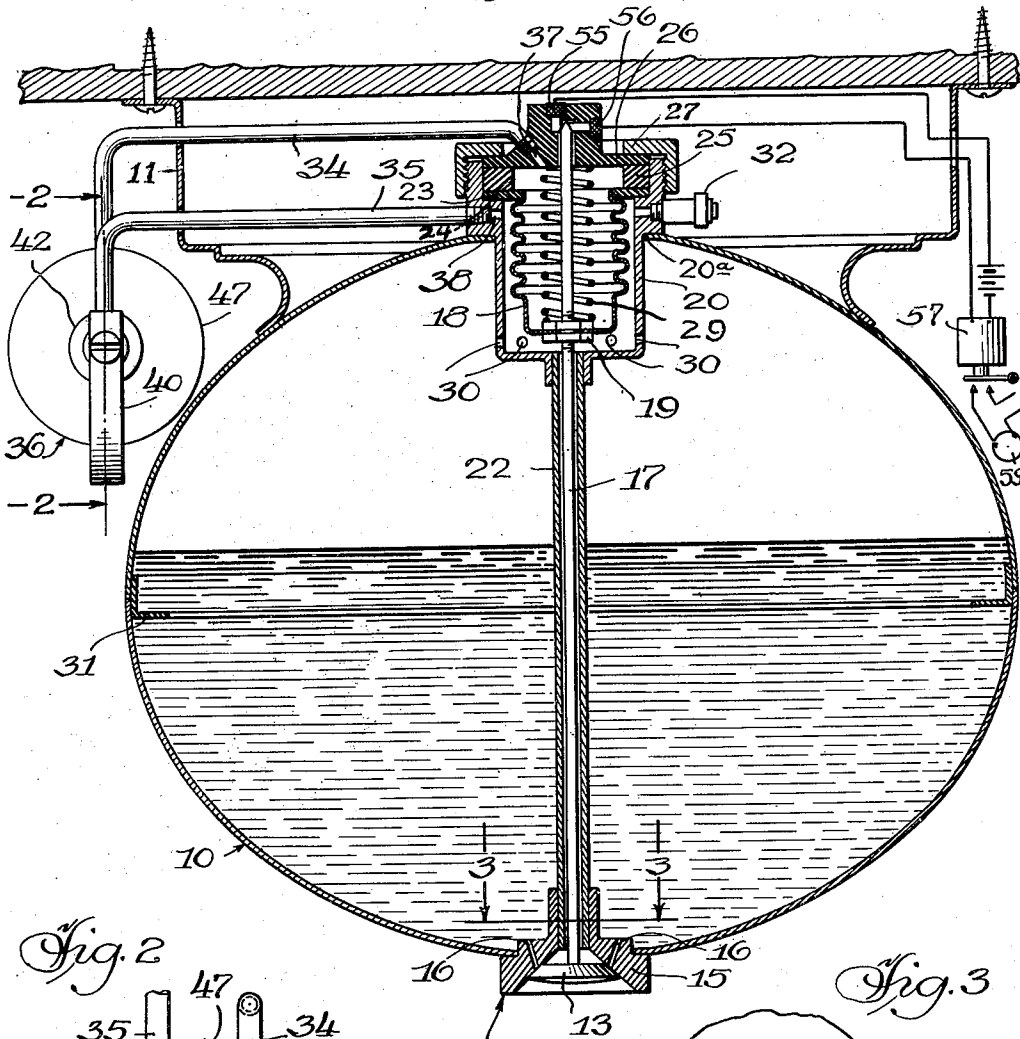


Fig. 2

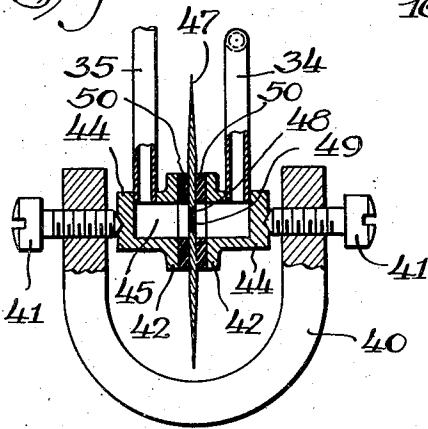
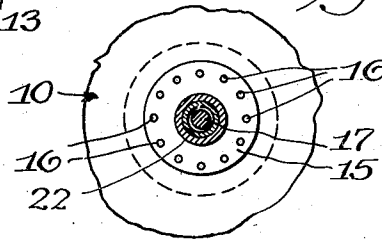


Fig. 3



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AUTOMATIC FIRE EXTINGUISHING DEVICE

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This invention relates to improvements in fire extinguishing devices employing a new principle of atomizing and vaporizing a suitable liquid for the purpose of instantaneously forming a thick and heavy layer of a fire extinguishing gas.

The principal object of the invention is to provide a novel device and method for automatically detecting and smothering the fire when it first starts, and for preventing its continuance by surrounding the point of ignition and adjacent areas with a blanket of fire extinguishing agent in its most efficient gaseous form.

Experience and common knowledge shows that many liquid chemical extinguishing agents such as carbon tetrachloride depend for their fire extinguishing action upon sufficient vaporization to surround and exclude oxygen from the blazing material. Such agents have no more than the ordinary cooling effect of water when they are applied to the blaze in liquid form.

In carrying out my invention, I provide an improved form of container for a liquid fire extinguishing agent such as carbon tetrachloride, especially adapted to be installed as independent units or fixtures to protect predetermined areas, and having means for automatically releasing the liquid in an atomized form in such quantities as to form a blanket of gas for excluding oxygen from the blaze.

The invention may best be understood by reference to the accompanying drawing, in which:

Figure 1 is a view in vertical section showing a fire extinguishing device constructed in accordance with my invention.

Figure 2 is a detail section of the heat-sensitive unit employed for automatically releasing the liquid from the device.

Figure 3 is a section taken on line 3—3 of Figure 1.

Referring now to details of the embodiment of my invention illustrated in the drawing, 10 indicates a hollow metal containing vessel, herein spheroidal in shape, having a canopy 11 at its upper end adapted to fit against the ceiling of a room so that the body of the container is suspended above the area to be protected. The container has a discharge valve fitting indicated generally at 12 at its bottom consisting of a valve member 13 fitting against a tapered opening in a valve seat 15. Said valve fitting has a plurality of small apertures 16, 16, leading into the tapered opening in the valve seat so as to permit escape of liquid in a finely atomized spray when the valve member 13 is opened by movement away from said valve seat.

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The movement of the valve member 13 is controlled through a rod 17 extending upwardly axially of the container and suitably connected to a bellows member 18, as by nuts 19 threaded on the upper end of said rod.

The bellows 18 extends upwardly in a cylindrical casing 20 fitting in the top wall 21 of the container. In the form shown herein, the casing 20 has a flared shoulder 20a which is secured to said container wall as by welding, and also has a reduced tubular extension 22 extending downwardly and rigidly connected at its lower end to the discharge valve fitting 12. The valve rod 17 is movable in, and spaced from the side walls of the tubular extension 22, as shown. The casing 20 with its tubular extension 22 therefore forms, in effect, a through-bolt for reenforcing the walls of the container, and maintaining the operating parts of the valve and its control mechanism in proper spaced relation.

The upper end of the bellows 18 has an outwardly extending flange 23, sealed against a shoulder 24 in the widened upper end of casing 20 as by a spacing ring 25 held in place by a cap 26 which encloses the top of said casing. In the form shown, said cap is secured by a retaining ring 27 threaded on the upper end of the casing. A coil spring 29 is interposed between the cap 26 and the nut 19 at the lower end of the bellows 18.

The interior of the casing 20 is normally open to the interior of the container body 10 as by a plurality of apertures 30, 30 surrounding the lower end of said casing, outside of the bellows 18.

With the spheroidal form of container body 35 shown herein, the said body is made in upper and lower half-sections, joined together as by welding to a horizontally disposed, flanged ring 31 on the interior of said container body.

The arrangement of parts so far described is such that a quantity of fire extinguishing fluid such as carbon tetrachloride may be put into the container body so as to partially fill the latter and be placed under pressure by air or other suitable gas, pumped into said container above the level of the liquid, as indicated in Figure 1 of the drawings. Pressure may be applied through a check valve 32 herein shown as mounted on the side wall of the casing 20 outside of the bellows 18.

The pressure in the container communicates freely through the apertures 30, 30 in the lower end of casing 20, and is exerted against the bellows 18 so as to force the latter upwardly against the compression of spring 29, thus closing the valve member 13. It will be understood that the

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effective area of the bellows 18 is substantially greater than the effective area of the valve member 13 and that the pressure in the space within and above the bellows 18 in casing 20 is initially at atmospheric pressure, when pressure is applied to the interior of the container.

Referring now to the means for automatically releasing the liquid when a fire occurs, tubes 34, 35, are connected to a heat-responsive device indicated generally at 36. One tube 34 communicates through port 37 in cap 26 with the exterior surface of the bellows 18, while the other tube 35 communicates with the interior of the container body 10 through port 38 in one side of casing 20 below the bellows. The arrangement is such, that when open communication between the tubes 34 and 35 is established, the pressure within the container body below the bellows 18 becomes equalized with that effective on the top of the bellows, so as to release the discharge valve under compression of said bellows and the spring 29.

Details of the heat-responsive device 36 are shown in Figure 2. Said device consists of a C-shaped clamp 40 having a pair of opposed adjusting screws 41, 41 in the jaws thereof which engage similar circular end plates 42, 42. Each of said end plates has a centrally disposed boss 44 with a port 45 therein opening toward the center of the end plate and communicating with one of the tubes 34 or 35 leading to the extinguisher unit. An enlarged metal disc 47 is mounted between the opposed end plates 42, 42. Said disc has a centrally disposed aperture 48 which is closed by a fusible plug 49 which normally forms a fluid-tight barrier to seal off communication between the tubes 34 and 35. Heat insulating washers 50, 50 are interposed between each end plate 42 and the adjacent surface of the disc 47 to provide a fluid-tight joint when the end plates are clamped against the disc by the screws 41, 41.

The fusible plug 49 may be of any suitable material capable of becoming melted when heated to a relatively low temperature. For instance, said plug may be made of Wood's metal, which fuses at approximately 165° F. In the form shown said plug is retained in the aperture 48 of the disc 47 by providing said aperture with V-shaped side walls and pressing or expanding the plug securely within said aperture to form a fluid-tight seal. The disc 47 is preferably made of copper or similar heat conducting metal and is tapered toward its edges so as to afford a maximum heat conduction surface and a least heat absorptive mass, for the conducting the heat of the surrounding air quickly to the fusible plug. The heat insulating washers 50, 50 resist dissipation of heat to the end plates 42, 42.

The heat-responsive device 36 may be located at any suitable point adjacent to or remote from the container body 10 where it will give the most efficient action, depending upon the conditions and nature of the installation. In the form shown in Figure 1 the heat-responsive device is mounted immediately adjacent the canopy 11 so as to be near the ceiling where rising heat from an incipient fire will effect a prompt actuation of the device. The tubes 34, 35 can also be extended as desired so as to dispose the heat-responsive device 36 to a point nearer to where a blaze is likely to be started. The container 10 may be secured to the ceiling or other support by any suitable means. In the form shown the canopy 11 is provided with a plurality of

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screws around its flanged margin which can be screwed into such support.

The use and operation of the automatic extinguishing device above described will now be readily understood as follows:

A quantity of liquid fire extinguishing agent, of which carbon tetrachloride is a good example, is placed in the container body 10 under pressure. The container may be made of sufficient size to hold two or three quarts of such liquid when about half full, leaving a space above the liquid level for the introduction of air or gas under pressure so as to fully charge the container and compress the bellows 28 to maintain the discharge valve 13 in closed position. It would be understood that when air pressure is applied to the interior of the container the fusible plug 49 in the heat-responsive device 36 will form a barrier between the exterior and interior surfaces of the bellows 28 so that said bellows will be compressed against atmospheric pressure above the bellows and in the upper end of the casing 20 and the tube 34 leading to one side of said fusible plug, and the coil spring 29 will also be compressed. The arrangement is such that the increased pressure within the container body is sufficient to maintain the discharge valve 13 in closed position indefinitely, until the fusible plug 49 in aperture 48 becomes melted under fire conditions. Thereupon communication is immediately established between the exterior and interior surfaces of the bellows, so as to counterbalance the pressure on opposite sides of the latter, and permit the valve member 13 to be opened by expansion of the bellows and the coil spring 29. Opening of the discharge valve will cause the fire extinguishing liquid to be discharged under pressure through the small discharge orifices 16, 16 in the tapered valve seat 14, and at the same time gas under pressure is discharged from above the liquid level through apertures 30, 30 in casing 20 and between the rod 17 and the surrounding walls of the tubular extension 22 so as to mix with and atomize the liquid as it is discharged from the tapered valve seat 14. Thus, the liquid will be atomized immediately in fine particles and spread laterally over a wide area below the extinguishing device.

The ratio of extinguisher liquid discharged through apertures 16, 16 and the amount of gas discharged through the extension tube 22 may be determined by experiment to produce the desired atomizing effect, depending upon the nature of the extinguishing fluid, the gas pressure, and the relative volume of liquid and gas employed in the container. This ratio may be controlled by various means, as for instance, by providing an optimum ratio between the total area of the holes 30, 30 in casing 20 and the discharge orifices 16, 16 in the valve member 12.

It will be understood further that special advantages are attained by utilizing a fire extinguishing agent which vaporizes readily at approximately the same, or slightly below the melting point of the fusible plug 49 used in the heat-responsive device 36. For instance, where carbon tetrachloride is employed (which vaporizes at about 165° F.) the fusible plug made of Wood's metal is designed to melt at 165° F. Consequently, when the heat of the surrounding air has been raised by an incipient fire to the point where the heat-responsive device is actuated, and the liquid is discharged in atomized form from the container, the temperature will be sufficient to vaporize the discharged fluid immediately upon

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contact with the heated air, so as to form a blanket of gas, heavier than air, which will descend at once and envelope the blaze and surrounding area so as to exclude oxygen from the blaze and put out the fire.

My improved form of extinguishing device is particularly effective when a plurality of them are disposed at pre-determined spaced intervals of room or building areas to be protected from fire, so that each device serves a pre-determined area. My improved device is, therefore, suitable for replacing more expensive and complicated water sprinkler systems and has the additional advantages of providing a fire extinguishing agent which is usually much more efficient than water, and does not cause so much damage to a wide variety of goods and furnishings. My improved form of extinguisher is also more efficient than portable extinguishers of the type commonly used inasmuch as it is always ready for automatic action within its prescribed area, and does not depend upon the human element for its proper effectiveness.

Although I have suggested the use of carbon tetrachloride as a preferred fire extinguishing agent, it will be readily understood that other chemicals having fire extinguishing characteristics can be employed if desired. In fact, water can likewise be used to give comparatively limited and yet effective results, where the use of chemicals may be prohibitive.

As an additional safety feature for my improved fire-extinguishing device, an electric alarm circuit of any suitable form may be employed in conjunction therewith to give an automatic signal when the device operates to release its charge either due to fire or by accident. In the form shown herein the valve control rod 17 is extended into the cap 26 at the upper end of the casing in position to engage contacts 55 and 56 in said cap which herein is made of a suitable non-conducting material. The contacts 55 and 56 are bridged by rod 17 as long as the device is in fully charged condition, so as to keep a relay 57, disposed at some remote point, energized. When the rod 17 is moved to open the atomizer nozzle, however, the relay will be de-energized to cause a suitable electric signal 59 to be operated in the usual manner.

Although I have shown and described a certain embodiment of my invention, it will be understood that I do not wish to be limited to the exact construction shown and described, but that various changes and modifications may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. In a fire-extinguishing device, a container for holding a quantity of liquid fire-extinguishing agent, and a gas under pressure, an atomizing discharge nozzle communicating with said container, a valve means responsive to the pressure in said container for closing said nozzle, and means responsive to predetermined temperature conditions for rendering said pressure-responsive means inoperative so as to cause said valve to open and discharge the liquid through said atomizing nozzle under pressure of the gas in said container.

2. In a fire-extinguishing device comprising a closed container for holding a quantity of liquid fire-extinguishing agent, and a gas under pressure, atomizing nozzle means for said container having a fluid discharge orifice communicating with the latter near its bottom, and a gas dis-

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charge orifice communicating with said container near its top, valve means responsive to the pressure in said container for closing said nozzle means, and means responsive to predetermined temperature conditions for rendering said pressure-responsive valve-closing means inoperative so as to cause a mixture of liquid and gas to be released through said nozzle under pressure of said gas.

3. In a fire-extinguishing device, a container for holding a quantity of liquid fire-extinguishing agent, and a gas under pressure above said liquid, an atomizing nozzle having a liquid discharge outlet communicating directly with the bottom of said container, and a conduit leading from said nozzle to a point above the normal liquid level in said container, a pressure-responsive diaphragm communicating with the interior of said container, valve means connected with said diaphragm arranged to close said liquid discharge outlet and conduit under a predetermined pressure in said container, and other conduit means for effecting communication between opposite sides of said diaphragm under predetermined temperature conditions so as to permit said valve means to open under the pressure in said container.

4. In a fire-extinguishing device, a container for holding a quantity of liquid fire-extinguishing agent, and a gas under pressure above said liquid, said container having a discharge nozzle at its lower end, a pressure-responsive diaphragm having communication at its inner side with the interior of said container, a valve for said nozzle having operating connection with said diaphragm but said diaphragm having a greater effective area than that of said valve so as to close said nozzle under predetermined pressure conditions in said container, and pressure conducting means affording connection between the interior of said container and the outer side of said diaphragm normally having a heat-responsive barrier therein, and operative upon disrupting of said barrier to equalize the pressure on opposite sides of said diaphragm, and thereby permit said valve to open under the pressure in said container.

5. In a fire-extinguishing device, a container for holding a quantity of liquid fire-extinguishing agent, and a gas under pressure above said liquid, said container having a discharge nozzle at its lower end, a conduit leading from said nozzle to the upper part of said container, a pressure-responsive diaphragm having communication at one side with the interior of said container, a valve for said nozzle having operating connection with said diaphragm through said conduit, said diaphragm having a greater effective area than that of said valve so as to close said nozzle under predetermined pressure conditions in said container, and pressure conducting means affording connection between the interior of said container and the exterior of said diaphragm normally having a heat-responsive barrier therein, and operative upon disrupting of said barrier to counteract the pressure on the interior of said diaphragm, and thereby permit said valve means to open said nozzle under the pressure in said container.

6. In a fire-extinguisher or the like, a closed container, a hollow tubular member rigidly connecting opposite walls of said container, said tubular member having an enlarged portion at one end, pressure-responsive diaphragm means in said enlarged portion, discharge valve means

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for said container mounted on the opposite end of said tubular member, and means operatively connecting said valve means with said diaphragm means, extending through said tubular member.

7. In a fire-extinguisher or the like, a closed container, a hollow tubular member rigidly connecting opposite walls of said container, said tubular member having an enlarged portion at one end having detachable closure means accessible from the exterior of said container, pressure responsive diaphragm means in said enlarged portion, discharge valve means for said container mounted on the opposite end of said tubular member, and means operatively connecting said valve means with said diaphragm means, extending through said tubular member.

8. In a fire-extinguisher or the like, a closed container for holding a quantity of liquid and a gas above said liquid under pressure for atomizing said liquid, a hollow tubular member rigidly connecting opposed upper and lower walls of said container, an atomizing nozzle for said container mounted on the lower end of said tubular member having liquid discharge outlet means communicating with the lower portion of said container, valve means in said nozzle, valve control means at the upper end of said tubular member connected to said valve by a rod extending through said tubular member, said tubular member also having gas discharge outlet means disposed adjacent to upper end thereof above the normal liquid level in said container.

9. In a heat-responsive control device, the combination of a pair of opposed end members having aligned ducts therein, a barrier member disposed between said end members and having an aperture therethrough registering with said ducts, said barrier member including a metal plate extending radially beyond said end members and having a plug in said aperture fusible under predetermined temperature conditions for permitting communication between said ducts.

10. In a heat-responsive control device, the combination of a pair of opposed end members having aligned ducts therein, a barrier member disposed between said end members and having an aperture therethrough registering with said ducts, said barrier member including a metal plate extending radially beyond said end members and tapered toward its margins, said barrier member also having a plug in said aperture fusible under predetermined temperature conditions for permitting communication between said ducts.

11. In a heat-responsive control device, the combination of a pair of opposed end members

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having aligned fluid ducts therein, a barrier member disposed between said end members and having an aperture therethrough registering with said ducts, said barrier member including a metal plate extending radially beyond said end members, said barrier member having a plug in said aperture fusible under predetermined temperature conditions for permitting communication between said ducts, and heat insulating washers interposed between said metal plate and each of said end members.

12. In a heat-responsive control device, the combination of a pair of opposed end members having aligned fluid ducts therein, a barrier member disposed between said end members and having an aperture therethrough registering with said ducts, said barrier member including a metal plate extending radially beyond said end members, and having a plug in said aperture fusible under predetermined temperature conditions for permitting communication between said ducts, and means for clamping said end members together to retain said barrier member in place therebetween.

13. In a fire extinguisher, a casing containing a body of fire-extinguishing liquid and a gas under pressure positioned thereabove, a valve positioned in said casing below the liquid level therein and through which said liquid can be expelled by the expansion of said gas, and means to open said valve, said means including: a pressure-operated bellows in said casing exposed exteriorly to the collapsing force of said gas under pressure, a spring tending to expand said bellows against said pressure, a conduit interiorly connecting said bellows to said gas under pressure, and a fusible disc normally closing said conduit and adapted to melt in the presence of a predetermined temperature to open said conduit to enable gas under pressure to balance said collapsing force and permit said spring to expand said bellows to open said valve.

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