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EXPLOSION SUPPRESSION DEVICE

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Fig. 1

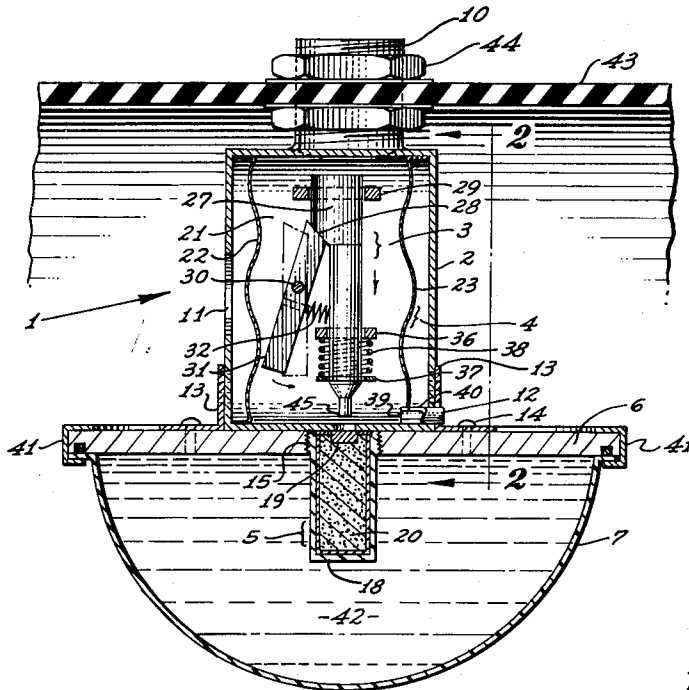


Fig. 2

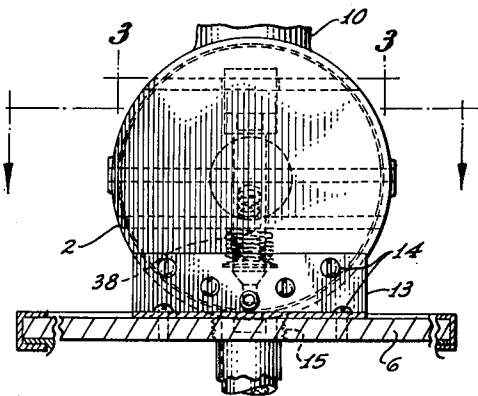
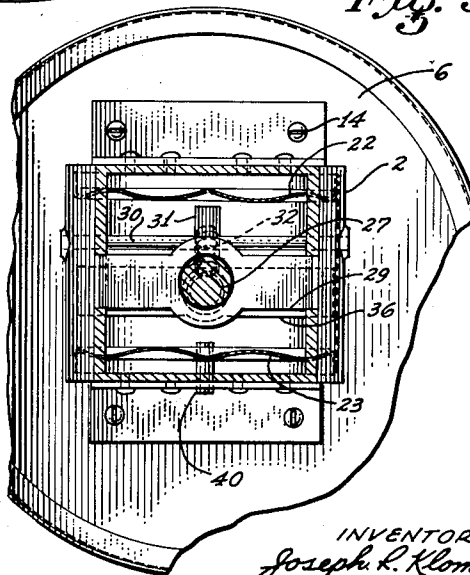


Fig. 3



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EXPLOSION SUPPRESSION DEVICE

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5 Claims. (Cl. 169—4)

My invention relates to devices for suppressing explosion within enclosed areas and is of the kind in which a pressure responsive arrangement is effective to detonate an explosive charge to shatter a frangible container holding flame smothering liquid which is thereby dispersed into the enclosed area, the device being operated by explosive rises in pressure in the enclosed area but not by gradual increases thereof.

A problem arising constantly wherever fuel or other volatile fluids are contained in an enclosed structure is the danger of explosion from the fumes therein. No particular problem presents itself when the tank is full, or when the pressure rise within the structure is gradual. However, upon a rapid rise in the pressure within a short increment of time due to an explosive potential, a means for smothering the flame must be found. An example of such a problem would be that of a warplane having a red hot shell fragment piercing through the gas tank and a resultant explosion from the volatile fumes therein.

It is, therefore, an object of my invention to provide an explosion suppression device effective to respond within a fraction of a second to a sudden rise in pressure within an enclosed structure.

A further object is to provide an inexpensive, compact and light weight mechanism which will efficiently suppress explosions within a confined area having volatile fumes therein.

Other objects and advantages will present themselves in view of the subsequent disclosure wherein a detailed description of a preferred embodiment will be given in connection with the accompanying drawings forming a part of the specification.

Figure 1 is a fragmentary cross-sectional view of the assembled device of this invention.

Figure 2 is a fragmentary cross-sectional view along the line 2—2 of Figure 1.

Figure 3 is a fragmentary cross-sectional view along the line 3—3 of Figure 2.

Referring in detail to the drawings, the suppression device 1 comprises a housing member 2, firing means 3, sensitive actuating means 4, explosive means 5, supporting means 6, and a containing means 7.

The housing member 2 is formed with a boss 10 to enable the member 2 to be secured from its upper end. An aperture 11 and an orifice 12 smaller in area than aperture 11 are provided on the sides of the housing member 2. A supporting means 6 which may be a backing plate is secured to the housing member 2 in any conventional manner such as by screwing one to the other through flanges 13 on the housing member 2 and screws 14. A tapped hole 15 is made in the plate 6 to receive explosive means 5 encased in a plastic casing 18 formed with threads so as to threadably engage the plate 6. The explosive means 5 is made up of a primer cap 19 and a detonator 20, the former when struck being effective to actuate the latter. Secured within the housing member 2 and forming a chamber 21 therein, are two diaphragms 22 and 23 of thin metallic composition which

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are sensitive to pressure changes and respond thereto by deflecting inwardly when the pressure on the outside of the chamber 21 is greater than the internal pressure of said chamber 21. A firing pin 27 having an inwardly sloping abutment shoulder 28 is constrained to vertical movement by an apertured guiding member 29 anchored in the housing member 2. Pivotaly secured to the housing 2 at 30 is a sear 31 having an upper end surface complementary to the abutment shoulder 28 of the firing pin 27. Located to bear against the firing pin 27 and the sear 31 at a point below the pivot 30 of the sear 31 is a compression spring 32 secured to the sear 31 and tending to keep the sear 31 in its contact position with the abutment shoulder on pin 27 under conditions of bumping or vibration. An apertured strap 36 through which the pin 27 passes is arranged below the spring 32 and is anchored in the housing member 2. An abutment member 37 which may be a pin extended through the lower end of the firing pin 27 or a washer placed in a peripheral groove in said firing pin 27, is located below the member 36. Intermediately disposed on the firing pin between the member 36 and the abutment member 37 is a compression spring 38 tending to force the firing pin 27 downwardly. The firing pin 27 and the primer cap 19 are placed in axial alignment for purposes of detonation. An orifice 39 is made in diaphragm 23 in alignment with orifice 12 and a small tube 40 connects the two orifices, 12 and 39. Releasably fastened to the plate 6 by means of flange caps 41 is a frangible plastic cup or containing means 7 capable of holding about 500 cubic centimeters of an explosion suppressive fluid 42 such as carbon tetrachloride. The device 1 may be secured to an enclosed structure 43 by forming the housing member 2 with a threaded boss 10 and boring a complementary hole in the structure to allow the boss 10 to pass through and be secured on the other side by a nut 44. Other convenient means of attachment suggest themselves, such as use of an angle bracket, or tie rods extending from the plate 6, or the like thereof.

The operation of my invention follows. During conditions of steady pressure within the enclosed structure in which the device 1 is placed, or, under conditions of gradual pressure rise within the structure, the metallic diaphragms are maintained in equilibrium. This is due to the fact that the pressure within the structure, such as a gas tank, which is being exerted against the diaphragm 22 through the aperture 11, is counteracted by the internal pressure in the chamber 21 which is of the same magnitude and enters the chamber 21 through orifices 12 and 39. Under the impetus of an explosive rise in pressure due to flame propagation, the internal pressure of the chamber 21 is unable to obtain the pressure level of the enclosed structure 43 in time to prevent the deflection inwardly of diaphragm 22. Deflecting the diaphragm 22 inwardly causes it to contact the lower end of the sear 31 most nearly adjacent to the diaphragm 22, thus pivoting the sear 31 out of engagement with the firing pin abutment shoulder 29. Once the restraining element has been removed, the spring 38 is able to throw the firing pin 27 downwardly until the point 45 thereof impinges against the primer cap 19 which actuates the detonator 20, bursting the frangible cup 7 holding the explosion suppressive fluid 42. Dispersal of the fluid 42 throughout the enclosed structure 43 will very rapidly smother the flame of the explosion, thus reducing the pressure below the explosion level that it had attained prior to such dispersal.

The device 1 is calibrated to cause deflection of the diaphragm 22 within milli seconds after the pressure within the enclosed structure 43 has risen to an explosive degree. More than one device 1 may be placed in an enclosed structure 43 to take into account different atti-

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tudes of the structure, as an airplane in a climb or a dive. Thus even where one device 1 is totally immersed in the fluid, another device 1 in a different location on the ceiling of the structure 43 will be effective to respond to an explosive pressure.

While in order to comply with the statute, the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprises a preferred form of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

What is claimed is:

1. A self-contained explosion suppression device of the kind described, comprising: an apertured housing; flexible diaphragm means dividing said housing and provided with a restricted orifice; a firing pin mounted within said housing; resilient means urging said firing pin toward firing position; detent means engageable with said firing pin and mounted in said housing to be operable by movement of said flexible diaphragm and effective to hold said firing pin from movement against the effort of said resilient means until actuation of said detent by movement of said diaphragm means to release the firing pin.

2. An explosion suppression device in accordance with claim 1 further characterized by two thin metallic diaphragms mounted in said housing, one of said diaphragms having an orifice therein.

3. An explosion suppression device in accordance with claim 1 further characterized by means constraining the firing pin to vertical movement; an abutment on said pin;

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and a pivotally mounted sear in engagement with the abutment on said pin, said sear being caused to pivot out of engagement with the abutment on said pin by virtue of the engagement therewith of said diaphragm when deflected by a sudden increase in pressure.

4. An explosion suppression device in accordance with claim 3 further characterized by a compression spring secured to said firing pin and said sear effective to hold the sear in contact with the abutment on said pin against vibration and jarring forces impressed on the enclosed structure.

5. A self-contained explosion suppression device of the kind described, comprising: a housing having a first opening therein; a second opening in said housing smaller in area than said first opening; flexible diaphragm means dividing said housing and subjected on opposite sides to the pressure transmitted through said first and second openings; a firing pin mounted within said housing; resilient means urging said firing pin toward firing position; detent means engageable with said firing pin and mounted in said housing to be operable by movement of said flexible diaphragm and effective to hold said firing pin from movement against the effort of said resilient means until actuation of said detent by movement of said diaphragm means to release the firing pin.

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