Aug. 13, 1935. D. MAPES 2,011,368

AUTOMATIC FIRE EXTINGUISHING SYSTEM AND APPARATUS

Filed Nov. 10, 1932 2 Sheets-Sheet 1

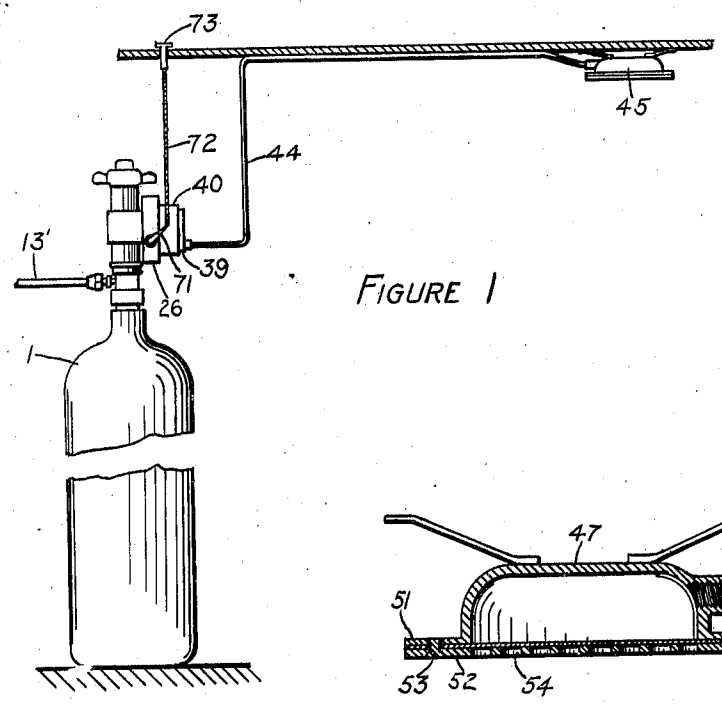


FIGURE 1

FIGURE 3

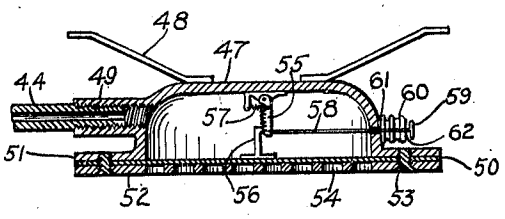


FIGURE 4

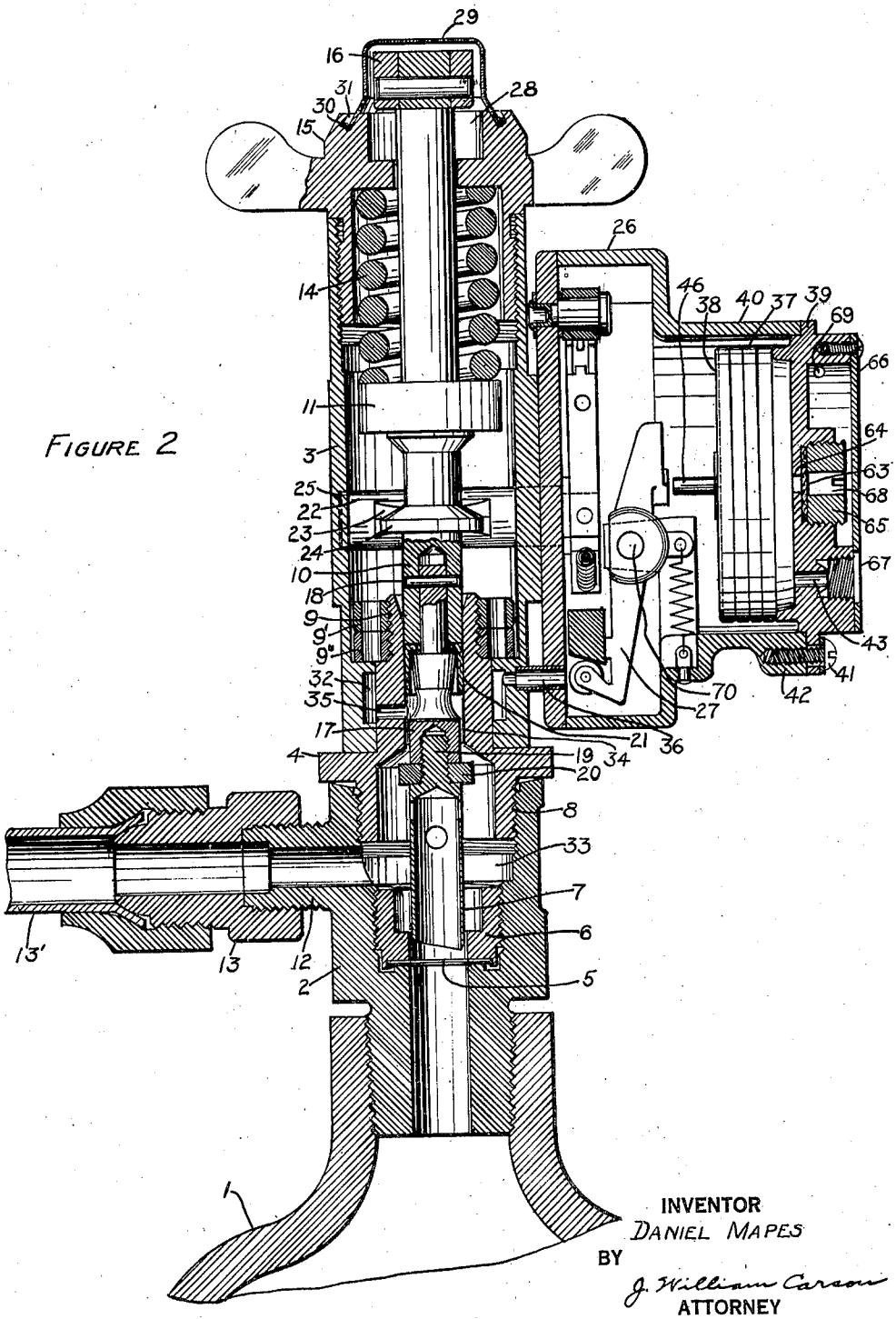
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AUTOMATIC FIRE EXTINGUISHING SYSTEM AND APPARATUS

Filed Nov. 10, 1932 2 Sheets-Sheet 2

FIGURE 2



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UNITED STATES PATENT OFFICE

2,011,368

AUTOMATIC FIRE EXTINGUISHING SYSTEM AND APPARATUS

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Application November 10, 1932, Serial No. 641,970

18 Claims. (Cl. 169—11)

The present invention relates to fire extinguishing systems of the type employing extinguishing mediums stored under pressure in suitable containers, for example, carbon dioxide stored in liquid form, which has been found to be very effective in combating quick-burning fires, such as fires of inflammable liquids and in electrical equipment, because of the large quantity that can be conducted quickly in its compact liquid form to the seat of a fire where it instantaneously expands substantially five hundred-fold into the form of a fire smothering gas, which, by reason of its three-dimensional extinguishing action, quickly permeates the space afire and extinguishes every vestige of flame.

It is, of course, desirable with systems of this type to release the fire extinguishing medium as quickly as possible after the inception of a fire so that the necessary concentration of the extinguishing medium can be quickly built up, but there are certain instances in which the release of the fire extinguishing medium is highly desirable before the fire has gotten beyond its incipient stage.

Although systems have been proposed in which the release of fire extinguishing mediums under pressure is accomplished automatically, as by thermostatic elements controlling electrical releasing circuits, the chief reliance has been upon manually initiated releasing operations, whether the releasing operation be accomplished by direct manual control or indirectly through electrical or pneumatic controlling means. In any event the systems previously proposed, whether automatically or manually operated, have not had the desired rapidity of operation.

It is accordingly an object of the present invention to provide an automatic system with means for releasing a fire extinguishing medium under pressure during the incipient stage of a fire. More specifically, the invention contemplates that said means be arranged for operation by the expansive force of a confined body of air, and in a preferred embodiment of the invention, that the confined body of air be vented to the atmosphere, a feature in itself already known, whereby the releasing apparatus can be designed to be unaffected by normal changes in the temperature of the surrounding atmosphere, but to become immediately operative upon abnormal changes in temperature such as accompany an incipient fire.

From another point of view, it has long been known that serious fires may result from explosions, and it would accordingly be highly advantageous if means could be provided for operating a fire extinguishing system of the type hereinabove referred to substantially simultaneous with the development of an explosion wave.

It is accordingly another object of the present invention to provide means operable by the force of an explosion for effecting the release of a fire extinguishing medium under pressure, such means being preferably adapted for use with automatic fire extinguishing systems of the type herein-above proposed.

A feature of the present invention which enables the maximum rapidity of operation thereof to be utilized is the provision of means normally tending to release the fire extinguishing medium and means normally holding the last named means in restraint, said restraining means being operated by the expansive force of the confined body of air, whereby rapid release of the fire extinguishing medium can be effected by the employment of a relatively large fire extinguishing medium releasing force controlled by the relatively small force developed by the pressure of the confined body of air.

A further object of the invention is to provide means for manually releasing the fire extinguishing medium to supplement the automatic releasing means.

A still further object of the invention is to provide a novel means for indicating both the intentional release of the fire extinguishing medium and its accidental release.

These, and further objects of the invention not specifically enumerated above, will be apparent as the invention is described in greater detail in connection with the accompanying drawings, wherein:

Figure 1 is a view in side elevation of a fire extinguishing system constructed in accordance with the present invention.

Figure 2 is a view in section, taken through the axis of the fire extinguishing medium releasing mechanism shown in Figure 1.

Figure 3 is a view in section, taken through the axis of the actuator shown in Figure 1.

Figure 4 is a view in section, taken through an axis of a modified form of actuator.

Referring to the above drawings, particularly Figure 2, a container 1 is provided, within which a supply of a fire extinguishing medium under pressure is maintained by means of a closure body 2 and a bonnet 3. An adapter 4 serves to maintain the bonnet upon the closure body, the latter being threaded into the top of the container 1 and being provided with a frangible disc

5 secured in position by a nut 6. A cutter 7 is movable within the nut 6 and the adapter 4 is provided with threads 8 which engage cooperating threads formed on the closure body 2, the adapter 4 being secured to the bonnet 3 by means of threaded nuts 9' and 9'' engaging cooperating threads 9 on an extension of the adapter.

Axially movable within the bonnet is a cutter stem 10 which is formed with a flange 11. An outlet 12 is provided in the closure body for receiving a fitting 13 which is adapted to be connected to a discharge line 13'.

A spring 14, which provides the actuating force for moving the cutter and cutter stem toward the container, is seated against a nut 15 which is a combined sealing nut and resetting nut, a stop 16 being provided on the upper end of the stem to limit the movement of the stem toward the container. The stop 16 also serves as an indicator, in a manner which will be hereinafter described.

The cutter 7 is secured to the cutter stem 10 through an intermediate member 17, which is specially designed to cooperate with the indicating means for indicating the release of the fire extinguishing medium. At its upper end the intermediate member is secured to the cutter stem 10, as by means of a pin 18. The cutter 7 is secured to the lower end of the intermediate member 17 by means of a threaded extension 19 engaging cooperating threads in the intermediate member, a lock-nut 20 serving to secure the parts firmly. A leather washer 21 is secured in position between the cutter stem 10 and the intermediate member 17, for a purpose which will be described later.

Extending within the bonnet 3 is a spindle 22 which is formed with a groove 23 for engaging a flange 24 on the cutter stem. The spindle is pivoted in the bonnet at 25 and extends externally thereof within a lever chamber 26, this lever chamber being suitably secured to the bonnet.

The foregoing description relates to a disc rupturing mechanism and means for discharging the contents of a fluid container into a pipe line, such as have been found particularly adaptable for use with the present invention. The means for releasing the foregoing mechanism include a series of levers arranged within the lever chamber 26 and serving to hold the spindle 22 in restraint until such time as the lever system is actuated. Since the lever system itself forms no part of the present invention, it has neither been shown nor will it be described in detail herein, as a suitable lever system has already been shown and described in my copending application for Letters Patent of the United States, Serial No. 515,717, filed February 14th, 1931. For the purpose of the present invention it is sufficient to note that actuation of the last lever of the series, shown at 27, disengages the entire lever system and permits spindle 22 to turn under the force exerted by spring 14 to disengage groove 23 from the flange 24. Such disengagement permits the cutter 7 to be advanced into the disc 5 and effects the rupturing thereof, thus causing the discharged medium to flow into the pipe line 13', the stop 16 receding within a recess 28 in the nut 15 and seating therein, thus serving to limit the downward movement of the cutter 7.

In accordance with the present invention, the recession of the stop 16 within the nut 15 serves as an indication that the release mechanism has been operated. In order to render the indicating means more effective in its indication, a suitable inscription such as "Set" may be made on the circumference of the stop 16, and an opaque cap 29, with a transparent circumferential band, may be secured to the nut 15 over the stop 16, as by means of split ring 30 snapping into a groove 31. With this construction the inscription "Set" would normally show through the transparent band, but upon actuation of the releasing means, the inscription would disappear within the recess in the nut 15.

The indication given upon the accidental release of the fire extinguishing medium, as upon rupturing of the frangible disc 5 upon the development of an excessive pressure within the container 1, is exactly the same as the indication given upon the intentional operation of the releasing mechanism. However, a novel means is employed to effect this indication, and this means will now be described. It will first of all be noted that the lower end of the bonnet 3 is provided with a recess 32 and that communication is established between the chamber 33 in the closure body 2 and the recess 32 through an annular space 34, between an internal bore of the adapter 4 and the intermediate member 17, and by a passage or passages 35 in the adapter 4. A passage 36 also extends from the recess 32 within the lever chamber 26 at a point directly opposite one end of the lever 27. When, therefore, the fire extinguishing medium is accidentally released upon rupturing of the frangible disc 5, some of the medium is directed from the chamber 33 through the passages 34 and 35 the recess 32 and the passage 36 against the end of the lever 27, actuating the lever 27 and disengaging the lever system, causing the cutter stem to be advanced and the indicator 16 to recede within the recess 28 in the nut 15.

It will accordingly be seen that the indication given upon accidental release of the fire extinguishing medium is the same as that given upon intentional release thereof by operation of the releasing mechanism.

In order to prevent discharge of the fire extinguishing medium through the passage 36, either upon intentional operation of the releasing mechanism or subsequent to the operation of the releasing mechanism by an accidental discharge of the fire extinguishing medium, the leather washer 21 is arranged to cover the passage 35 when the cutter stem is fully advanced.

The manner in which the lever 27 is actuated in accordance with the present invention will now be described. This actuation is effected by a bellows-like member 37 provided with a closed end 38 and supported on its open end by means of an air-tight connection with the member 39. The member 39 is supported on an extension 40 of the lever box 26 by means of screws 41 inserted into supporting lugs 42 carried on the extension 40. A passage 43 in the member 39 communicates with the interior of the bellows-like member 37 and is adapted to be connected to a tube 44 (see now Figure 1) to the other end of which is connected an actuator 45, the latter of which serves to develop the operating pressure for the releasing mechanism. Upon the development of the necessary operating pressure, the bellows-like member 37 moves toward the left, carrying with it the pin 46 which is secured to the closed end 38 of the member 37. The pin 46 then forcibly engages the lever 27, causing it to disengage the lever system and permitting the releasing mechanism to be actuated in the manner already described.

The present invention also contemplates man-

ual emergency operation of the lever 27, and this is effected by suitably extending the shaft 70 (see Figure 2) of the lever 27 externally of the lever chamber 26, connecting to it a lever 71 (see Figure 1), a cable 72 and an operating handle 73. From the foregoing description, it will be apparent that a pull on the operating handle will cause the lever 27 to disengage the train of levers normally holding the releasing mechanism in restraint, thus permitting the releasing mechanism to be actuated.

The construction of the actuator member 45 will now be described in connection with Figure 3, wherein 47 represents a chambered body member having suitable supporting legs 48 by means of which it may be secured in any desired position. The body member 47 has a projection 49 communicating with the interior thereof and adapted for connection to the tube 44. A diaphragm 50 of some suitable material of considerable flexibility is secured in an air-tight manner between a flange 51 on the body member and a cover plate 52 by means of screws 53. The cover plate 52 is provided with a number of openings 54, preferably covering the entire portion of the cover plate overlying the chamber of the body member 47.

With this construction it is intended that any explosion wave developing in the vicinity of an actuator 45 will flex the diaphragm inwardly to such an extent as to increase the pressure in the body member 47 and the tube 44 to extend the bellows-like member 37 and actuate the lever 27, thus actuating the releasing mechanism.

In the event, however, that a fire occurs in the neighborhood of an actuator 45, unaccompanied by any explosion, the heating of the actuator will cause an increase in pressure sufficient to extend the bellows-like member 37 and actuate the releasing mechanism. Under this condition any tendency of the flexible diaphragm 50 to flex outwardly is prevented by the perforated cover plate 52, the openings 54 serving to submit the diaphragm to explosion waves, but being of such size as to prevent any material flexing of the diaphragm outwardly.

Figure 4 shows a modified construction of the actuator shown in Figure 3, the reference numerals of Figure 3 having the same significance in Figure 4. Figure 4 differs from Figure 3 in the provision of means for retaining the diaphragm 50 in its inwardly flexed position subsequent to subjection to an explosion wave, said means comprising a multiple-toothed member 55 pivotally supported on the interior of the body member 47, and a toothed member 56 supported on the inner side of the flexible diaphragm 50. The teeth on the members 55 and 56 are so designed that the member 55, under the influence of a spring 57 will retain the member 56 and the diaphragm to which it is attached in any position to which the diaphragm is flexed.

With this construction the pressure developed by an explosion wave is maintained for a period after the termination of the explosion wave sufficient to effect extension of the bellows-like member 37 and the actuation of the releasing mechanism.

Resetting of the actuator of Figure 4 is effected by a link 58 passing through an opening in the body member 47 and terminating in a knob 59. The air-tight construction of the actuator is maintained by a bellows-like member 60, secured air-tight to the body member at 61 and to the link at 62.

In apparatus of this type it is desirable that the releasing mechanism be not actuated upon normal changes in temperature of the surrounding atmosphere. In order to prevent such undesired actuation upon normal changes in temperature, it is usual to provide a minute vent in the enclosed air system, permitting the pressure developed upon normal changes in temperature to be communicated to the external atmosphere, the size of the vent, however, being such that it cannot relieve the pressure occasioned by a rapid rise in temperature such as accompanies an incipient fire, or at least, not until the releasing mechanism has been actuated.

Such a vent can effectively be located at any suitable and convenient point, but in the present case it has been incorporated directly in the releasing mechanism shown in Figure 2. In this figure, 63 represents a disc of porous material, e. g., blotting paper, having a slight porosity to air under a slight pressure. This porous disc is supported over an opening 64, communicating with the interior of the bellows-like member 37, by a threaded nut 65 engaging cooperating threads in the member 39. A cover plate 66 is provided to complete the assembly, this cover plate having an opening 67 for the tube 44. The porosity of the disc 63 is such that upon slight changes in pressure in the enclosed body of air due to normal changes in temperature, the pressure is dissipated through the porous disc, the opening 68 in the nut 65, and the opening 69 in the wall of the member 39, the latter opening communicating with the atmosphere. The porosity of the disc 63, however, is such that the releasing mechanism will be actuated before the pressure developed by rapid rise in temperature of the enclosed body of air can be dissipated.

From the foregoing description it will be seen that my present invention embodies the important objects pointed out at the beginning, and while the invention resides in certain principles of construction and operation which have been illustrated and described in connection with the accompanying drawings, it will be apparent to those skilled in the art that they can, of course, be embodied in other forms of construction without departure therefrom, and I do not wish to be strictly limited for this reason to the disclosure, but rather to the scope of the appended claims.

I claim:

1. An actuator for use with apparatus adapted to be actuated by the expansive force of a confined body of air and adapted to actuate such apparatus upon the development of an explosion wave, comprising an air confining chamber adapted to conduct heat to the confined air from external media and adapted to be connected with the apparatus to be actuated and having an opening, a flexible diaphragm supported over said opening in a manner to decrease the volume of the chamber upon the development of an explosion wave, and means to support the flexible diaphragm against movement in a direction which would increase the volume of the chamber.

2. An actuator for use with apparatus adapted to be actuated by the expansive force of a confined body of air and adapted to actuate such apparatus upon the development of an explosion wave, comprising an air confining chamber adapted to conduct heat to the confined air from external media and adapted to be connected with the apparatus to be actuated and having an opening, a flexible diaphragm supported over

said opening in a manner to decrease the volume of the chamber upon the development of an explosion wave, means to support the flexible diaphragm against movement in a direction which would increase the volume of the chamber, and means to maintain the flexible diaphragm in an actuated position after the termination of the explosion wave.

3. An actuator for use with apparatus adapted to be actuated by the expansive force of a confined body of air and adapted to actuate such apparatus upon the development of an explosion wave, comprising an air confining chamber adapted to conduct heat to the confined air from external media and adapted to be connected with the apparatus to be actuated and having an opening, a flexible diaphragm supported over said opening in a manner to decrease the volume of the chamber upon the development of an explosion wave, means to support the flexible diaphragm against movement in a direction which would increase the volume of the chamber, means to maintain the flexible diaphragm in an actuated position after the termination of the explosion wave, said last named means comprising a spring-controlled catch, and manually-operable means for releasing the catch to permit the return of the flexible diaphragm to its normal position.

4. A container for a medium under pressure, a discharge line, means normally tending to release the medium, means normally holding the last named means in restraint comprising a series of interengaging levers, the last of which can be tripped to remove the restraint, means to release the medium upon the development of a predetermined excess pressure in the container, indicating means, means to actuate the indicating means by the means normally tending to release the medium, means to trip the last named lever intentionally, and means to direct the medium against the last named lever to trip it when the medium is released due to excess pressure.

5. A container for a medium under pressure, a discharge line, means normally tending to release the medium, means normally holding the last named means in restraint comprising a series of interengaging levers, the last of which can be tripped to remove the restraint, means to release the medium upon the development of a predetermined excess pressure in the container, indicating means, means to actuate the indicating means by the means normally tending to release the medium, means to trip the last named lever intentionally, means to direct the medium against the last named lever to trip it when the medium is released due to excess pressure, and means to shut off the flow of the medium against the last named lever as soon as the means normally tending to release the medium has been actuated thereby.

6. A container for a medium under pressure, a discharge line, means normally tending to release the medium, means normally holding the last named means in restraint, means to release the medium upon the development of a predetermined excess pressure in the container, indicating means, means to actuate the indicating means by the means normally tending to release the medium, means to release the restraining means intentionally, and means to release the restraining means by the medium when released due to excess pressure.

7. A container for a medium under pressure, a discharge line, means to release the medium intentionally, means to release the medium upon the development of a predetermined excess pressure in the container, indicating means, means to actuate the indicating means by the means to release the medium intentionally, means to actuate the means to release the medium intentionally, and means to actuate the last named means by the medium when released due to excess pressure.

8. A container for a medium under pressure, a discharge line, means to release the medium intentionally, means to release the medium upon the development of a predetermined excess pressure in the container, indicating means, means to actuate the indicating means by the means to release the medium intentionally, and means to actuate the means to release the medium intentionally to actuate the indicating means by the medium when released due to excess pressure.

9. A container for a medium under pressure, a discharge line, means to release the medium intentionally, means to release the medium upon the development of a predetermined excess pressure in the container, indicating means, means to actuate the indicating means by the means to release the medium intentionally, and means to actuate the means to release the medium intentionally to actuate the indicating means upon release of the medium due to excess pressure.

10. The combination of a container for a medium under pressure, a discharge line, means normally tending to release the medium, means normally holding the last named means in restraint, means to release the medium upon the development of a predetermined excess pressure in the container, indicating means, means to actuate the indicating means by the means normally tending to release the medium, means to release the restraining means by the medium when released due to excess pressure, and means to release the restraining means intentionally comprising pressure actuated means for effecting release of the restraining means, an air confining chamber adapted to conduct heat to the confined air from external media and adapted to be connected to the pressure actuated means and having an opening, a flexible diaphragm supported over said opening in a manner to decrease the volume of the chamber upon the development of an explosion wave, and means to support the flexible diaphragm against movement in a direction which would increase the volume of the chamber.

11. The combination comprising a container for a medium under pressure, a discharge line, means normally tending to release the medium, means normally holding the last named means in restraint comprising a series of interengaging levers, the last of which can be tripped to remove the restraint, means to release the medium upon the development of a predetermined excess pressure in the container, indicating means, means to actuate the indicating means by the means normally tending to release the medium, means to trip the last named lever intentionally, said last named means comprising pressure actuated means for tripping the last named lever, an air confining chamber connected thereto having an opening, a flexible diaphragm supported over said opening in a manner to decrease the volume of the chamber upon the development of an explosion wave, and means to support the flexible diaphragm against movement in a direction which would increase the volume of the chamber, means to direct the medium against the last named lever to trip it when the medium is released due to excess pressure, and means to shut off the flow of

the medium against the last named lever as soon as the means normally tending to release the medium have been actuated thereby.

12. A container for a medium under pressure, a discharge line, a frangible disc for confining the medium in said container, said disc bursting at a predetermined excess pressure in the container, means to release the medium intentionally comprising a cutter normally suspended above said frangible disc, a spring normally tending to force said cutter through said disc, a series of intenengaging levers normally holding said spring in restraint, the last lever of said series being adapted to be tripped to remove the restraint, pressure actuated means adapted to trip the said last named lever, an air confining chamber connected to said pressure actuated means and having an opening, a flexible diaphragm supported over said opening in a manner to decrease the volume of the chamber upon the development of an explosion wave, means to trip said last named lever upon release of the medium due to the development of a predetermined excess pressure in the container, indicating means, and means to actuate the indicating means by the releasing means.

13. A combination comprising a container for a medium under pressure, a discharge line, means to release the medium intentionally, means to release the medium upon the development of a predetermined excess pressure in the container, indicating means, means to actuate the indicating means by the means to release the medium intentionally, means to actuate the means to release the medium intentionally comprising an air chamber, means associated therewith adapted to decrease the volume of said air chamber upon the development of excess pressure in external media, and means to actuate said indicating means by the medium when released due to excess pressure.

14. A combination comprising a container for a medium under pressure, a discharge line, means to release the medium intentionally, an air confining chamber, said last named means being actuated by the expansive force of the confined air in said chamber upon development of an explosion wave, said air confining chamber having an opening with a flexible diaphragm supported thereover in a manner to decrease the volume of the chamber upon the development of an explosion wave, means to prevent said flexible diaphragm from moving in a direction to increase the volume of the chamber, means to release the medium upon the development of a predetermined excess pressure in the container, indicating means, the said indicating means being actuated by the means to release the medium intentionally, and means to operate the means to release the medium intentionally by the medium when released due to excess pressure.

15. An actuator for use with apparatus adapted to be actuated by the expansive force of a confined body of air and adapted to actuate such apparatus upon the development of an explosion wave, comprising an air confining chamber adapted to conduct heat to the confined air from external media and adapted to be connected with the apparatus to be actuated, means associated with said chamber in a manner to decrease the volume of the chamber upon the development of an explosion wave and to thus increase the pressure of the confined body of air, and means to maintain the last named means in its actuated condition after the termination of the explosion wave.

16. The combination of a container for a medium under pressure, a discharge line, means normally tending to release the medium, means normally holding the last named means in restraint, means to release the medium upon development of a predetermined excess pressure in the container, indicating means, means to actuate the indicating means by the means normally tending to release the medium, means to release the restraining means by the medium when released due to excess pressure, and means to release the restraining means intentionally comprising pressure actuated means for effecting release of the restraining means, an air confining chamber adapted to actuate said pressure actuated means upon the development of an explosion wave, comprising an air confining chamber adapted to conduct heat to the confined air from external media and adapted to be connected with the pressure actuated means, means associated with said chamber in a manner to decrease the volume of the chamber upon the development of an explosion wave and to thus increase the pressure of the confined body of air, and means to sustain the pressure of the air for a period after the termination of the explosive wave sufficient to operate the apparatus to be actuated.

17. The combination comprising a container for a medium under pressure, a discharge line, means normally tending to release the medium, means normally holding the last named means in restraint comprising a series of interengaging levers, the last of which can be tripped to remove the restraint, means to release the medium upon the development of a predetermined excess pressure in the container, indicating means, means to actuate the indicating means by the means normally tending to release the medium, means to trip the last named lever intentionally, said last named means comprising pressure actuated means for tripping the last named lever, an air confining chamber connected thereto having an opening, a flexible diaphragm supported over said opening in a manner to decrease the volume of the chamber upon the development of an explosion wave, and means to support the flexible diaphragm against movement in a direction which would increase the volume of the chamber, and means to maintain the last named means in its actuated condition after the termination of the explosion wave.

18. In a release device for fluids under pressure having a frangible disc to confine a medium under pressure, a body member provided with an outlet, a puncturing member movable in the body and adapted to rupture the disc, means normally urging the puncturing member toward the disc, releasable means normally restraining the puncturing member against movement, means to release the medium upon the development of a predetermined excess pressure in the container, indicating means, means to actuate the indicating means upon operation of the puncturing member and means to release the restraining means by the impingement of the medium when released due to excess pressure on an element of the restraining means.

DANIEL MAPES.

6

CERTIFICATE OF CORRECTION.

Patent No. 2,011,368. August 13, 1935.

DANIEL MAPES.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 3, for "simultaneous" read simultaneously; page 5, first column, line 12, claim 12, for "intenengaging" read interengaging; same page, second column, strike out lines 29, 30 and 31, of claim 16, and insert instead maintain the last named means in its actuated condition after the termination of the explosion wave; and claim 17, line 53, beginning with the word "maintain" strike out all to and including the word "wave" in line 55, and insert instead direct the medium against the last named lever to trip it when the medium is released due to excess pressure; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 24th day of September, A. D. 1935.

(Seal)

Leslie Frazer
Acting Commissioner of Patents.