

Aug. 8, 1944.

W. A. V. THOMSEN

2,355,185

ACTUATOR

Filed March 19, 1941

2 Sheets-Sheet 1

Fig. 1

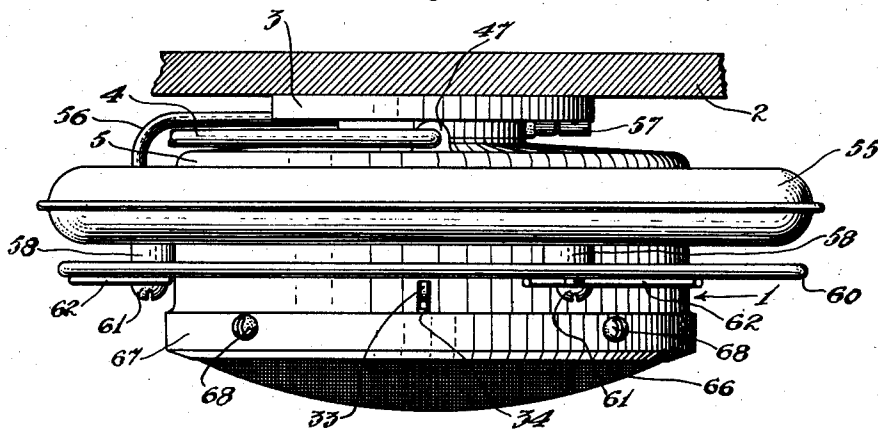
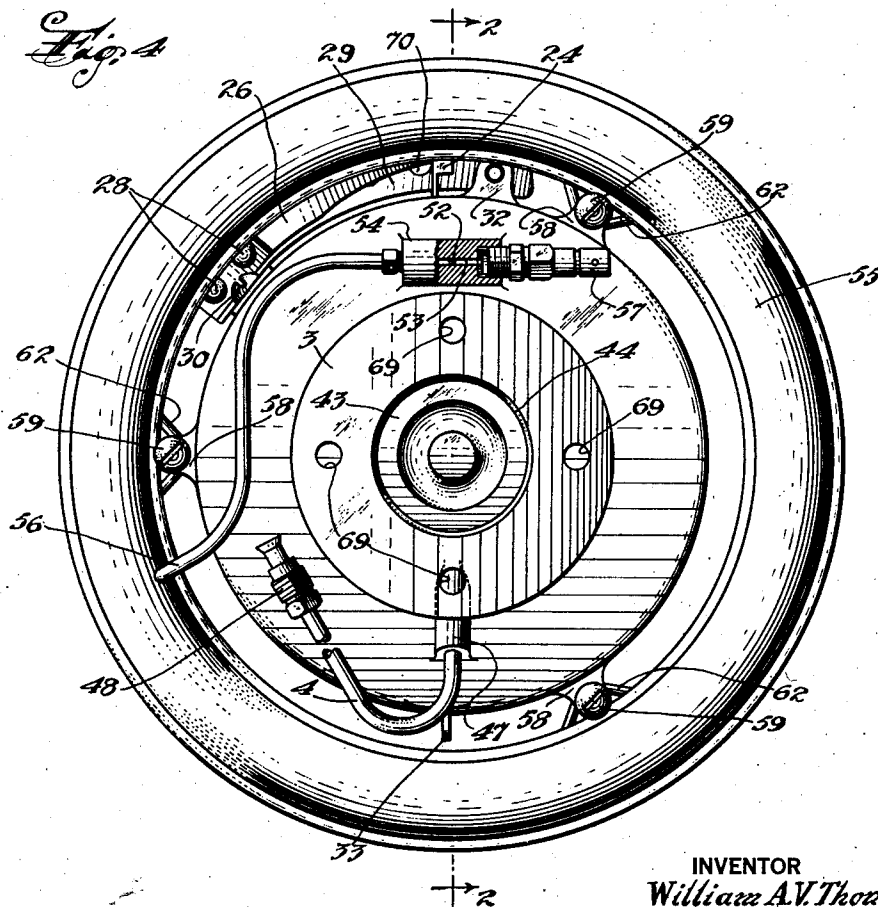


Fig. 4



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2 Sheets-Sheet 2

Fig. 2

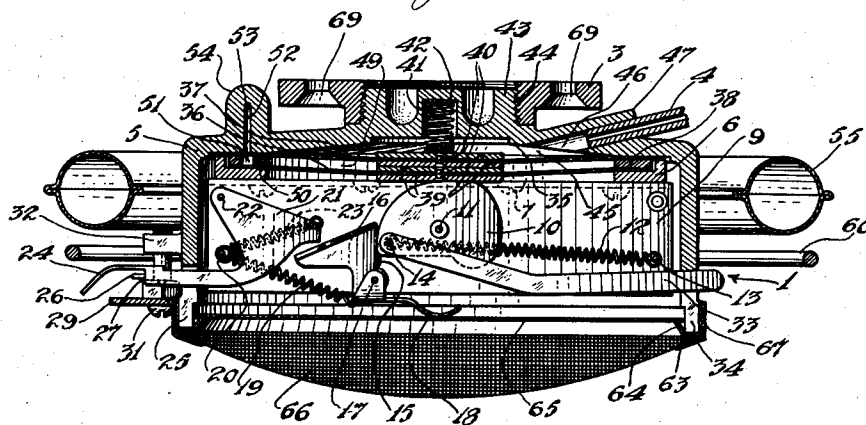
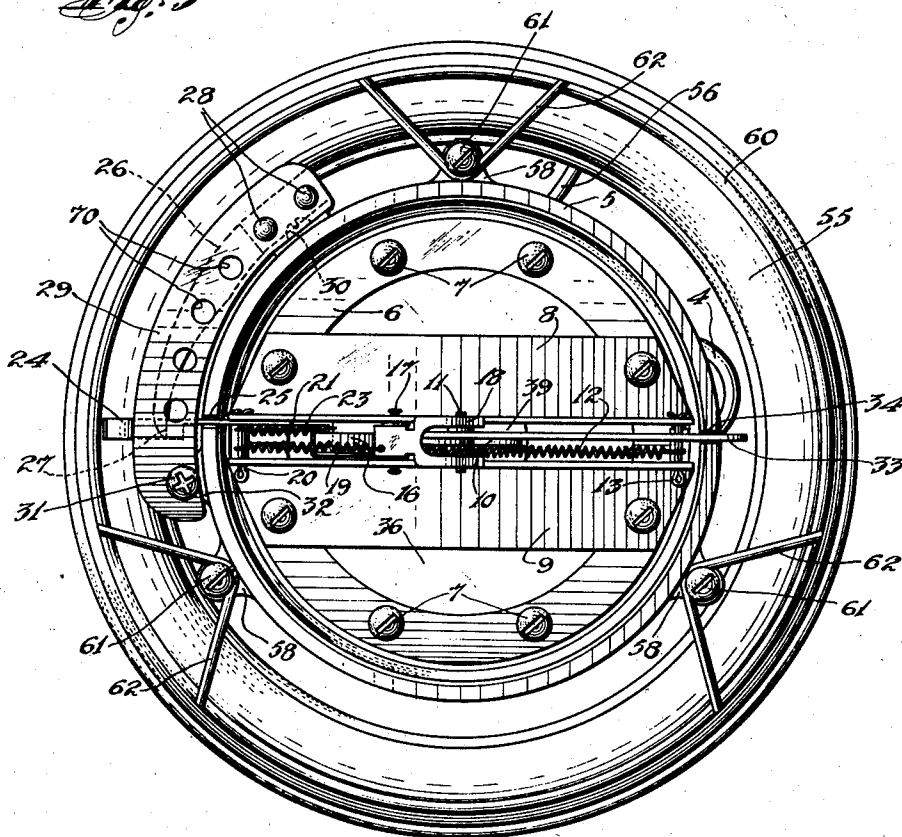


Fig. 3



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ACTUATOR

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13 Claims. (Cl. 169—1)

The present invention relates to automatic-fire extinguishing systems, and more particularly to a device for use with such systems, designed to actuate the systems in response to a variety of predetermined conditions attending the beginning of, or which may be the cause of a fire.

Fire extinguishing systems designed to protect a given locality generally comprise means to store a fire extinguishing medium, means to distribute the medium, and means to release the medium when required. The releasing means may be operable either manually or automatically, or both.

Automatic releasing means heretofore used have been somewhat limited in their usefulness, insofar as they usually have been responsive to only one of a number of possible conditions accompanying a fire, such as a predetermined fixed temperature, or a rise in temperature.

As fires may be started by any one of a number of causes, and under varying circumstances, the desirability will be apparent of providing for the responsiveness to as many conditions which may be present in the early stages of a fire as possible, when using an automatic fire extinguishing system.

Such automatic releasing means, as used heretofore, were usually responsive only to a single predetermined condition. This condition usually was pretty close to that of an actual fire in order to insure the functioning of the fire extinguishing system in any case. It is, of course, very desirable for any extinguishing apparatus to subdue a fire in its earliest stages, and possibly before it has had the opportunity to start.

In order to accomplish this, I realized that an automatic device for the actuation of a fire extinguishing system should be responsive to a variety of conditions, preferably associated with phenomena occurring in the incipient stages of the fire, rather than being associated with the fire itself. I also found it desirable, that each of these conditions should cause the actuation of the device in such a manner as to produce the same ultimate activating action in each case.

It is, accordingly, an object of the invention to provide an activating device for a fire extinguishing system which is similarly responsive to each of a plurality of predetermined and different conditions which precede a fire.

Another object of the invention is to provide an activator for an automatic fire extinguishing system which is highly sensitive and reliable for a plurality of given conditions associated with fire.

It is still another object of the invention to provide an activator of the type referred to, which,

in response to each of a number of predetermined conditions associated with fire, is adapted to produce an activating pressure impulse.

It is still another object of the invention to provide an activator, as above, which is, at all times, operative with respect to at least one of a number of given activating conditions, regardless of any previous responses which may have been caused by any of the other conditions.

A further object of the invention consists in the construction and arrangement of the parts of the device whereby the foregoing objects may be accomplished.

Other and further objects, not specifically enumerated above, will be apparent when described in greater detail in connection with the accompanying drawings, wherein:

Figure 1 is a view in side elevation of a device constructed and arranged in accordance with the present invention.

Figure 2 is a view in section, taken along the line 2—2 on Figure 4.

Figure 3 is a bottom plan view of the device with the cover removed to show its inside construction.

Figure 4 is a top plan view of the device.

Referring more particularly now to the drawings, there is shown in Figure 1 an actuator 1, constructed in accordance with the invention, and mounted on a surface 2, such as a ceiling of a room or compartment which is to be protected by a fire extinguishing system adapted to be actuated by an actuator of the type to be described. At 3 is seen a mounting flange, by means of which the actuator may be secured to the ceiling 2. A small bore tubing 4 serves to transmit activating pressure impulses from the actuator or the device to pneumatically responsive fire extinguishing medium releasing means, which forms no part of the present invention and which is not shown.

In Figures 2 and 3, the actuator 1 is shown to have a cup-shaped body member 5, designed to act as a housing for the mechanism of the device. A clamping ring 6 may be secured by means of screws 7 into the bottom of the cup-shaped body 5. The ring 6 mounts suitable supporting members 8 and 9, each comprising a portion parallel to the bottom of the actuator and another portion vertical thereto. The vertical portions of the supporting members are arranged in a spaced parallel relationship with respect to one another, and serve as bearing plates for the pivoted elements of the actuator mechanism as will appear presently.

The actuator mechanism comprises an actuating cam 10, pivotable about a pin 11 carried by the vertical plates just mentioned. A drive spring 12 (Figure 2) tends to rotate the cam 10 in a counterclockwise direction, being attached to a spring anchor 13 mounted in the vertical bearing plates, at one end, and by a rivet 14 secured to the cam 10, at the other end. The cam 10 is kept from rotating by latching with an offset portion 15 on a trigger member 16, which is pivoted on a pin 17 mounted in the bearing plates. The trigger 16 is formed with a two-pronged actuating lever 18 extending above the edge of the vertical portion of the bearing plates. The trigger 16 is held in its energized and latching position as shown, by a trigger spring 19, its ends being anchored at the end of the lever 18 adjacent the trigger, and on a spring anchor pin 20 mounted in the bearing plates, respectively.

A trigger tripping member 21, pivoted at 22, is urged to rotate in a clockwise direction by means of a trip spring 23 supported by the tripping member 21 and by the anchor pin 20. The tripping member 21 is formed with a lever 24 which extends to the outside of the housing 5 through a slot 25 in the wall thereof. The lever 24 is adapted to maintain the tripping member 21 in the position shown, against the force of the spring 23 by latching outside the housing 5 with a bi-metal thermostatic element 26, outlined in dashes in the view of Figure 3. A latch between the lever 24 and the element 26 is indicated at 27. The bi-metal element 26 is secured by means of rivets 28 to a member 29 adapted to serve as a guard, and which is provided with apertures 70 (Figure 3) along most of its length to facilitate the exposure of the element 26 to any rising air currents.

The guard member 29, in turn, is fastened to the outside of the housing 5 through the medium of a screw 30, shown outlined in Figure 3. The guard member 29 and with it the element 26 may be adjusted in their vertical position with respect to the lever 24 by means of an adjusting screw 31, which is threaded into a projection 32 formed on the housing 5. The guard and bi-metal assembly as a whole is easily pivotable about the screw 30, when the latter is loosened sufficiently.

At 33 is indicated a lever for resetting the cam 10. A slot 34 is provided in the housing 5 for the extreme end of the lever 33 which extends outside of the housing to permit of the manual resetting of the cam 10. The lever 33 is pivotable about the rivet 14, referred to above in connection with the drive spring 12.

Between the frusto-conically shaped bottom or floor 35 of the housing 5 and the cam 10, two diaphragms are disposed, indicated at 36 and 37, which are held in place by the clamping ring 6 and a spacer ring 38; the diaphragm 36 is being held between the rings 6 and 38, and the diaphragm 37 is held between the spacer ring 38 and the floor 35 of the housing 5. Each of the diaphragms, which may be made of varnished glass fabric to render them flexible and resistant to high temperatures, is provided centrally and on each side thereof with a flat rigid spacer disc 39, the two discs of each diaphragm being held together by a rivet 40. It is to be noticed that no operative connection exists between the diaphragms, and that the diaphragm 37 is capable of moving independently of the diaphragm 36. The diaphragms are maintained in the position shown in Figure 2 by the force of a spring 41 bearing against the disc shown uppermost in Fig-

ure 2 and being supported in a recess 42 formed in a boss 43 on the housing 5. The boss 43 is threaded at 44 to carry the mounting flange 3. A chamber 45, formed between the floor 35 of the housing 5 and the diaphragm 37, communicates with the tubing 4 through an aperture 46 in the floor 35 of the housing 5 and through a suitable connecting formation 47 formed in the floor of the housing.

Tubing 4, as outlined above, may lead to any desired pneumatically operable extinguishing fluid release mechanism (not shown). A connecting member 48 mounted on tubing 4 (Figure 4) serves to connect the device with suitable service piping which is not shown and which may lead to a pneumatic release mechanism. A chamber 49, formed between the diaphragms 36 and 37, through passages 50 and 51 in the spacer ring 38, and through passages 52 and 53 in a coupling formation 54 on the housing 5, is in fluid flow communication through one side of the coupling 54 with an annular air bulb 55, by way of a short piping 56.

The other side of the coupling 54 opens into a restricted or slow vent 57 (Figure 4), which is designed to permit the venting to the atmosphere at a predetermined rate of the otherwise closed space formed by the bulb 55 and the chamber 49. The form of vent, illustrated here, is of the exchangeable type which permits of the regulation of the maximum contemplated venting rate. The vent itself forms no part of the invention and may assume any desired form as long as it permits of the regulation of the venting rate. The bulb 55, which may consist of a hollow tubular metallic formation having thin and heat conducting walls, may be mounted concentrically with respect to the housing 5 on suitable projections 58 formed peripherally on the housing, and may be held there by screws 59. On the other side of the projections 58, a wire guard 60 is held fast by screws 61 threaded into the projections 58 and holding down guard supporting members 62, the whole serving to protect the thin-walled air bulb 55 from mechanical injury.

A ring-formed metallic frame 63 slipped over the edge of the housing 5, and bent inwardly as at 64, serves to support loosely on the bent-in portion 64 a thin disc 65, preferably of sheet mica, which is so dimensioned with respect to the inside diameter of the housing 5 as to be freely movable upwardly and downwardly therein, and which is so positioned as to bear very lightly against the trigger lever 18. The disc 65 is protected against accidental outside contact by means of a convex-shaped wire mesh screen 66 held in place by a ring-type frame 67 secured over the frame 63 by screws 68 threaded into the housing wall.

The whole device may be mounted on a supporting surface, such as a room ceiling as seen in Figure 1, by means of suitable screws for which apertures 69 are provided in the mounting flange 3.

The operation of the device is as follows:

Should an explosion occur, the pressure wave resulting therefrom, upon reaching the disc 65 through the screen 66, will cause an upward movement of the disc 65 (in Figure 2) and thereby will cause a temporary movement in a counterclockwise direction of the trigger lever 18 and the trigger 16. This movement of the trigger member causes the setting free of the eccentric or cam member 10, whereupon the drive spring 12 will rotate the cam 180° in a counter-clockwise

direction, into a released position. The rotation of the cam 10 effects an outward movement through the slot 34 of the reset lever 33, now acting as an indicator of the released condition of the cam. At the same time, due to the action of the cam, the spacer discs 39 and the two diaphragms 36 and 37 are thrust toward the floor 35 of housing 5. The chamber 45 is thus subjected to a decrease in its volume, a pressure wave or impulse thereby being set up through the tubing 4, where through the impulse is transmitted to a pneumatically operable release device (not shown) to operate it. As the cam 10 rotates to its completely released position, that is, to a position rotated 180° counter-clockwise from that shown in Figure 2, the spring 41 by its action on the uppermost of the discs 39 (Figure 2), returns the diaphragms to their original and non-actuated position as in Figure 2. The volume of the chamber 49 between the two diaphragms 36 and 37 in this case remains unaffected throughout, since there is no relative displacement of the diaphragms. Due to the small diameter of the tubing 4, and due to the design of the springs 12 and 41, considerable time is required for the pressure, set up by the movement of the diaphragms, to be transmitted therethrough. This condition serves to maintain a fairly high pressure in the chamber 45 and to slow up the rotation of the cam 10, preventing the immediate snapping around of the cam into its fully operated position. This is an intended manner of operation, since a pressure, sustained over a period of time, is required to effect the actuation of the pneumatic device connected thereto. After the complete release of the cam 10, the trigger spring 19 returns the trigger 16 to its original position. In order to reset the device, the cam is rotated back into its latched position with respect to the trigger 16 by manipulation of the reset arm 33. It is to be understood that only a true explosion, that is one, which will result in a pressure wave of the required suddenness will operate the disc 65, the slots 25 and 34 allowing pressure impulses having a suddenness less than that due to true explosions, to create a condition of counter pressure on the inside of the disc. Solutions, other than these slots, to create a similar effect, will suggest themselves to one skilled in the art.

In the absence of an explosion, actuation of the device may also be had by exposure to a predetermined temperature, which will cause the bi-metallic element 26 to warp and eventually to slide past the end of the trip lever 24. The tripping member 21 is now free to rotate in a clockwise direction due to the action of the trip spring 23. The tripping member 21 thereby is made to impart a rotative movement to the trigger 16, similar to that caused by the disc 65 in the case of an explosion, whereby the cam member 10 is released and an activating pressure impulse is generated by the diaphragms 36 and 37 as before. By proper selection of the thermostatic element 26, the actuator may be made to react to any temperature that may be desired. The adjusting screw 31 is used for close adjustment in a temperature range of about 100° F., for any given element. For resetting, following the operation by a fixed temperature, the trip lever 24 is pressed upwardly simultaneously with the manipulation of the reset arm 33. Both these levers serve in this case to indicate an operation due to a fixed temperature.

If the actuator is subjected to an excessive rate of rise in temperature, that is, one beyond a contemplated rate, the heated air in the annular bulb 55 expands to a degree which the calibrated vent 57 is not able to accommodate, whereby a pressure is set up, through the tube 56, in the space 49 between the diaphragms 36 and 37. The diaphragm 37 is thus forced upwardly to create a pressure impulse in the tubing 4 and toward a pressure responsive release mechanism which may be connected thereto. The movement, in this case, of the diaphragm 37, is quite independent of diaphragm 36 which remains stationary.

The construction of the device insures that its operation due to a rapid rise in temperature does not affect its readiness to operate by explosion or at a fixed temperature. Conversely, the operation of the device by an explosion or a fixed temperature does not affect its operation by a rise in temperature. The device is, thus, always operable by too rapid a rise in temperature. This feature, and the fact that the device need not be reset, after an operation due to a given rate of rise in temperature, are important aspects of the device, which have been so recognized by the board of underwriters' laboratories.

It will be recognized that if either an explosion or an excessive rate of rise in temperature for some reason is not capable of causing the actuator to operate to produce a pressure impulse, the bi-metallic fixed temperature element will act as a reserve protection, positively releasing the actuator when a given high temperature has been reached.

The vent, used in conjunction with the actuator, may be of any desired form, and, in the illustrated case, is of the exchangeable type, which permits the adjustment of the venting capacity of the air bulb 55 by a change to another vent of a suitable size. It is therefore possible, in the case of a supervisory system for detecting fires, employing a plurality of actuator devices in accordance with the invention, to have each device provided with the size vent best suited to the requirements of the locality which it protects. In other fire detecting systems, which utilize the rate-of-temperature-rise principle, a single vent has been used for several actuators, thereby making each of the actuators equally sensitive, which is, of course, never quite adequate for a proper supervision of the various localities. The provision of the diaphragm 37 has the effect of separating the heat responsive air bulb 55 from any other bulbs that may be in the service conduit connected to the tubing 5, whereby only the relatively small volume of air in the bulb 55 and the chamber 49 needs to be expanded by heat to cause a sufficiently large pressure impulse to be set up through the service conduit to obtain an actuation of the system. This condition makes it possible to use a larger number of actuators on the same service line than was possible heretofore, with a resultant increase in the sensitivity of the supervisory system as a whole. This construction, too, will prevent the entire system from becoming inoperative, should one of the bulbs be accidentally punctured.

The time of response of any pneumatic mechanism to a given rate of temperature increase largely depends upon the length of tubing to which the actuator may be connected, and may

be assumed to increase in direct proportion thereto.

From the foregoing description, it will be seen, that the present invention provides a reliable pneumatic type fire extinguishing system actuator, which is effective for a variety of conditions indicative of the incipience of a fire, and which is so constructed as to render systems, in which it is used, more sensitive and more efficient than was possible heretofore. It will also be seen that my invention accomplishes the various objects pointed out at the beginning of this specification. Finally, while my invention has been illustrated and described with specific reference to the accompanying drawings, it will be apparent to those skilled in the art that the invention resides in certain principles of construction and arrangement which may be embodied in various other forms without departing in any manner from the spirit and scope of the invention, and I therefore do not wish to be limited to the specific disclosure, but rather to the appended claims.

I claim:

1. In an actuator for use with a pneumatically responsive apparatus, the combination of a housing, chamber means in said housing having a diaphragm, spring means supported in the housing yieldingly opposing movement of said diaphragm to decrease the volume of said chamber means, outlet means for the chamber means adapted for connection to service tubing, a second diaphragm in the housing adjacent said first diaphragm forming a second chamber therewith, spaced means intermediate said diaphragms, an air bulb disposed on said housing, a restricted calibrated vent for said bulb, means forming a fluid flow communication between said bulb and said second chamber, supporting means in the housing, a cam to actuate said diaphragms carried by the supporting means; driving means for said cam, cam resetting means, means to indicate the position of the cam extending outside the housing, trigger means having a lever adapted to latch the cam in an energized position, all on said supporting means, an explosion actuatable member disposed in the housing adjacent said trigger lever adapted to act thereon to release the cam, releasable trigger trip means on said support having a lever, and an adjustable fixed temperature thermostatic element secured to the housing adapted in its non-actuated position to latch with said trip lever.

2. An actuator for use with pneumatically responsive apparatus comprising in combination: chamber means having a movable wall adapted by its movement to cause a change in the volume of said chamber means; and a plurality of means operatively associated with said wall for moving said wall in a manner to decrease the volume of said chamber means, each of said plurality of means being adapted to be affected by only one predetermined type of condition associated with fire, and each being independently and differently responsive to its respective type of condition; said chamber means being adapted to be in operative connection with the pneumatically responding apparatus, whereby upon the response of any of said plurality of means the increased pressure in said chamber means resulting from a decrease in the volume thereof is adapted to cause the actuation of the pneumatically responsive apparatus.

3. An actuator for use with pneumatically responsive apparatus comprising in combination:

chamber means having a movable wall adapted by its movement to cause a change in the volume of said chamber means; a plurality of means operatively associated with said wall for moving said wall in a manner to decrease the volume of said chamber means, each of said plurality of means adapted to be affected by only one predetermined type of condition associated with fire, and each being independently and differently responsive to its respective type of condition; and yieldable means operatively associated with said movable wall for resisting the actuation of said movable wall and adapted to effect the restoration of said wall; said chamber means being adapted to be in operative connection with the pneumatically responding apparatus, whereby, upon the response of any of said plurality of means, the increased pressure in said chamber means resulting from a decrease in the volume thereof is adapted to cause the actuation of the pneumatically responsive apparatus.

4. An actuator for use with pneumatically responsive apparatus comprising in combination: chamber means; means responsive to a predetermined rate of rise in temperature forming a movable wall of said chamber means and being adapted by its movement to cause a change in the volume of said chamber means; explosion responsive means; means responsive to a predetermined temperature, each of said three named responsive means being differently responsive to its respective type of condition, and means operatively associating said two last named responsive means with said movable wall in a manner to move said wall to decrease the volume of said chamber means; said chamber means being adapted to be in operative connection with the pneumatically responding apparatus, whereby upon the response of any of said three named responsive means the increased pressure in said chamber means resulting from a decrease in the volume thereof is adapted to cause the actuation of the pneumatically responsive apparatus.

5. An actuator for use with pneumatically responsive apparatus comprising in combination: chamber means; means responsive to a predetermined rate of rise in temperature forming a movable wall of said chamber means and being adapted by its movement to cause a change in the volume of said chamber means; explosion responsive means; means responsive to a predetermined temperature; each of said three named responsive means being differently responsive to its respective type of condition; and means operatively associating said two last named responsive means with said movable wall in a manner to move said wall to decrease the volume of said chamber means; and resetting means for said second and third named responsive means; said chamber means being adapted to be in operative connection with the pneumatically responding apparatus, whereby upon the response of any of said three named responsive means the increased pressure in said chamber means resulting from a decrease in the volume thereof is adapted to cause the actuation of the pneumatically responsive apparatus.

6. An actuator for use with pneumatically responsive apparatus comprising in combination: chamber means having a movable wall adapted by its movement to cause a change in the volume of said chamber means; a normally restrained actuating mechanism operatively associated with and adapted upon its release to move said wall in a manner to decrease the volume of

said chamber means; an explosion responsive member; a member responsive to a predetermined temperature, each of said members being constructed and arranged to release said mechanism, and each being independently and differently responsive to its respective type of condition; a fluid pressure generator responsive to a predetermined rate of rise in temperature; and means connecting said generator in fluid flow communication with said movable wall to effect the movement of said wall independently of said mechanism by fluid pressure in a manner to decrease the volume of said chamber means; said chamber means being adapted to be in operative connection with the pneumatically responding apparatus.

7. An actuator for use with pneumatically responsive apparatus comprising in combination: chamber means having a pair of movable walls, one of which is adapted by its movement to cause a change in the volume of said chamber means; a normally restrained actuating mechanism operatively associated with and adapted upon its release to move said wall in a manner to decrease the volume of said chamber means; an explosion responsive member; a member responsive to a predetermined temperature, each of said members being constructed and arranged to release said mechanism, and each being independently and differently responsive to its respective type of condition; a fluid pressure generator responsive to a predetermined rate of rise in temperature; and means connecting said generator in fluid flow communication between said pair of movable walls, whereby pressure created in said generator is adapted to effect movement of the wall adapted to cause a change in the volume of said chamber means.

8. In an actuator for pneumatically responsive apparatus, the combination of an air thermostat responsive to a given rate of rise in temperature adapted to generate a pressure impulse, said thermostat having vent means, pressure conserving chamber means having a diaphragm movable by pressure and a second movable diaphragm normally substantially adjacent to the first diaphragm operable to move said first diaphragm; mechanical means operatively associated with and operable to move said second diaphragm; and pressure impulse transmitting means in operative association with said chamber and adapted to be connected with a pneumatically responsive apparatus, whereby upon a response of said thermostat or upon operation of said mechanical means said first diaphragm is adapted to set up a pressure impulse in said transmitting means to operate the pneumatically responsive apparatus.

9. In an actuator for pneumatically responsive apparatus, the combination of an air thermostat responsive to a given rate of rise in temperature adapted to generate a pressure impulse, said thermostat having vent means; a chamber; pressure conserving chamber means having walls movable as a unit without change in its volume, one of said walls being a diaphragm separately movable by pressure and forming a wall of said chamber; means operatively connecting said chamber means to said thermostat for movement of said diaphragm by pressure; normally restrained mechanical means operatively associated with and operable to actuate said chamber means as a unit; pressure impulse transmitting means in operative association with said chamber and adapted to be connected with a pneumati-

cally responsive apparatus; and explosion actuated means for actuating said mechanical means; whereby upon a response of said thermostat or upon operation of said mechanical means said diaphragm is adapted to set up a pressure impulse in said chamber and said transmitting means to operate the pneumatically responsive apparatus.

10. In an actuator for pneumatically responsive apparatus, the combination of an air thermostat responsive to a given rate of rise in temperature adapted to generate a pressure impulse, said thermostat having vent means, a chamber; pressure conserving chamber means having walls movable as a unit without change in its volume, one of said walls being a diaphragm separately movable by pressure and forming a wall of said chamber; means operatively connecting said chamber means to said thermostat for movement of said diaphragm by pressure; normally restrained mechanical means operatively associated with and operable to actuate said chamber means as a unit; pressure impulse transmitting means in operative association with said chamber and adapted to be connected with a pneumatically responsive apparatus; explosion responsive means; and fixed temperature responsive means; said two last named responsive means being constructed and arranged to effect release of said mechanical means; whereby upon a response of said thermostat or upon operation of said mechanical means said diaphragm is adapted to set up a pressure impulse in said chamber and said transmitting means to operate the pneumatically responsive apparatus.

11. In an actuator for pneumatically responsive apparatus, the combination of chamber means having a movable member; normally restrained mechanical means to actuate said movable member in a manner to decrease the volume of said chamber; means yieldingly resisting the actuation of said movable member in a direction to decrease the chamber volume; pressure impulse transmitting means in operative association with said chamber and adapted to be connected with a pneumatically responsive apparatus; and explosion actuated means adapted to effect release of said mechanical means to operate said movable member; whereby upon the release of said mechanical means and upon the movement of said movable member the increased pressure in said chamber means resulting from a decrease in the volume thereof is adapted to cause the actuation of said pneumatic apparatus.

12. In an actuator for pneumatically responsive apparatus, the combination of chamber means having a movable member; normally restrained mechanical means at one side of said movable member structurally connected to said movable member adapted to actuate said movable member in a manner to decrease the volume of said chamber; means at the other side of said movable member yieldingly resisting the actuation of said movable member in a direction to decrease the chamber volume; pressure impulse transmitting means in operative association with said chamber and adapted to be connected with a pneumatically responsive apparatus; and fixed temperature responsive means adapted to effect release of said mechanical means to operate said movable member; whereby upon the release of said mechanical means and upon the movement of said movable member the increased pressure in said chamber means resulting from a decrease

in the volume thereof is adapted to cause the actuation of said pneumatic apparatus.

13. In an actuator of the type described, the combination comprising: a casing having an open end, a normally restrained actuating mechanism, means for effecting actuation of said mechanism including an operating member disposed in said casing, a diaphragm member responsive to pressure impulses due to an explosion, said diaphragm

member being at the open end of said casing and adjacent said operating member for effecting movement thereof, and slow fluid pressure impulse transmitting means at the open end of said casing, whereby said diaphragm member is affected only by the pressure impulses of a true explosion.

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