

[54] **COMBINATION DUAL TUBULAR
PRESSURE STORAGE MEANS AND
DISCHARGE FOR FIRE EXTINGUISHERS
AND LIKE APPARATUS**

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[58] Field of Search **169/26, 71, 75, 77, 85,
169/88**

[56] **References Cited**

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[57] **ABSTRACT**

A closed pressure container is provided and includes

an upper valved outlet. An upstanding tube assembly including concentric inner and outer tubes stationarily supported relative to each other is disposed within the container and the upper end of the outer tube is sealingly supported about the outlet and extends downward toward the lower end of the container with the outer surfaces of the outer tubular member spaced inwardly from the inner surfaces of the container, thus providing three concentric pressure chambers within the container. The outer annular area within the pressure container includes a lower portion for receiving dry chemicals and an upper portion for receiving compressed propellant gases. The innermost area comprises a secondary independent propellant gas storage chamber closed at its lower end by means of a selectively openable valve and the intermediate annular area defined between the inner and outer tubes defines a discharge passage upwardly through which dry chemicals may be propelled by the propellant gas upon opening of the valve at the outlet of the container. The valve at the outlet of the container includes a manual operator as well as a temperature responsive actuator. Also, a safety control is provided whereby the functional ability of the temperature responsive actuator is automatically registered by visual indicia in the event the temperature responsive actuator is rendered inoperative.

11 Claims, 10 Drawing Figures

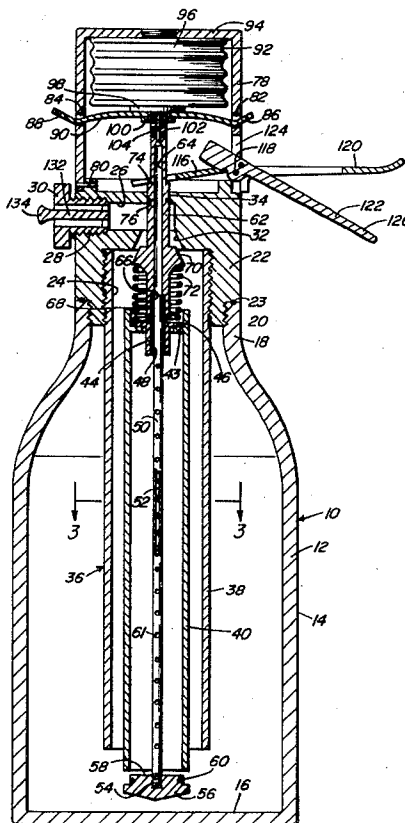


Fig. 1

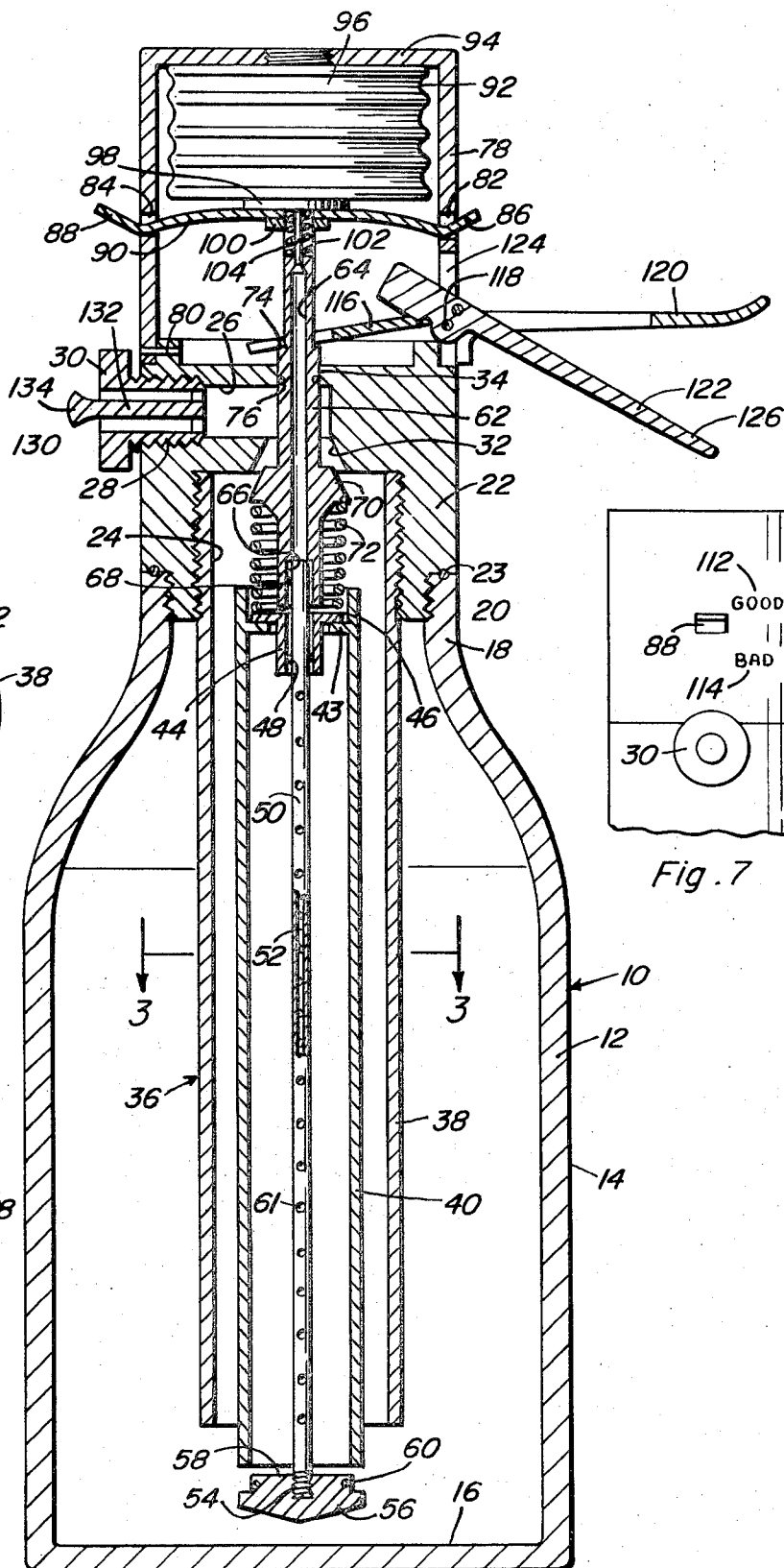


Fig. 3

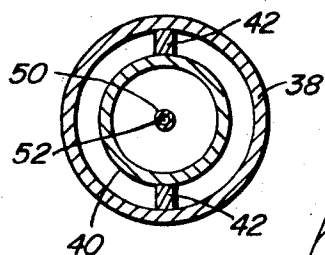


Fig. 8

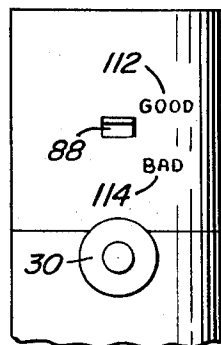
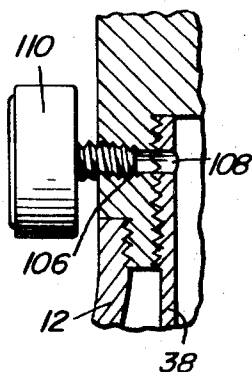


Fig. 7

Fig. 4

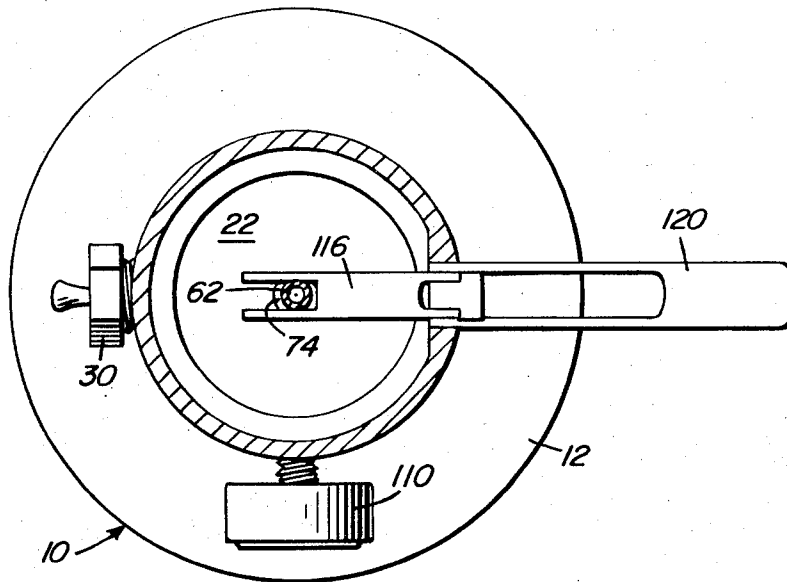


Fig. 2

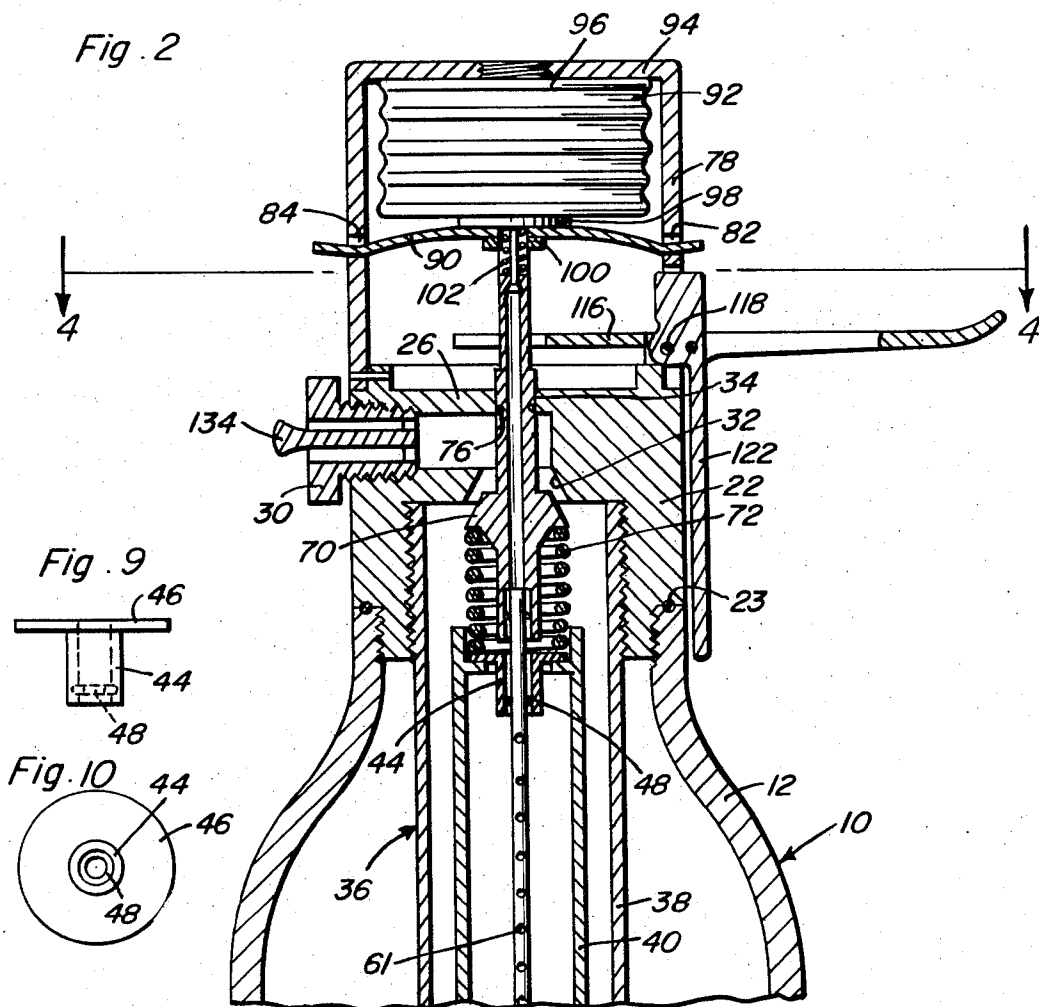


Fig. 5

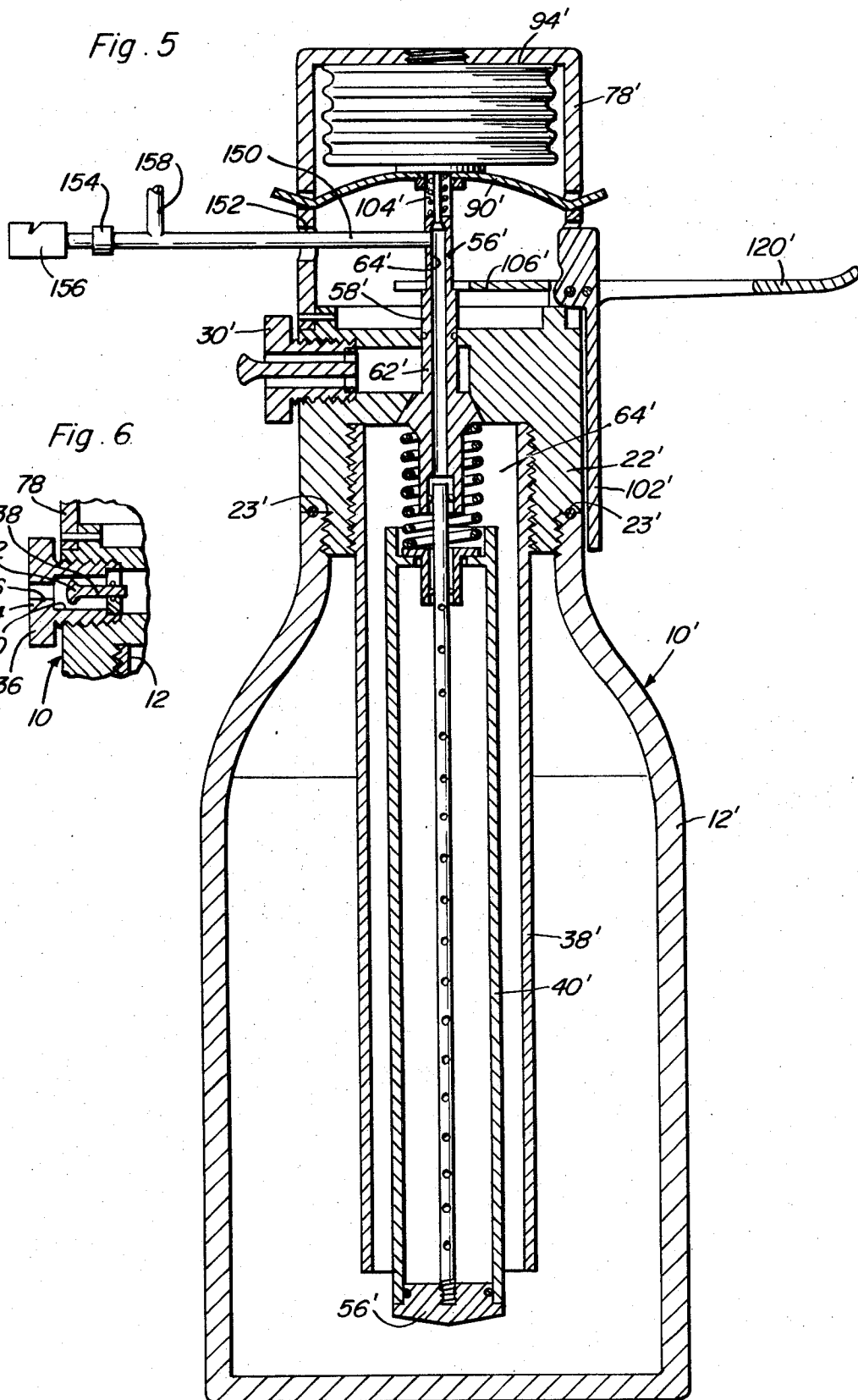
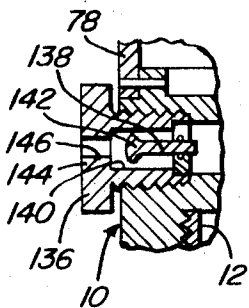


Fig. 6



COMBINATION DUAL TUBULAR PRESSURE STORAGE MEANS AND DISCHARGE FOR FIRE EXTINGUISHERS AND LIKE APPARATUS

BACKGROUND OF THE INVENTION

Dry chemical fire extinguishers occasionally malfunction, at least partially, due to the fact that dry chemical powder resting in the bottom of the pressurized container tends to be compacted by the pressure thereabove and to become packed in a manner preventing a full discharge of the powder by the propellant gases within the pressurized container upon the discharge valve of the fire extinguisher being opened. In addition, automatic temperature responsive fire extinguisher valve operating structures heretofore devised are subject to malfunction.

The fire extinguisher of the instant invention is constructed in a manner to substantially entirely eliminate the problem of only partial discharge of dry chemical powder in the event the latter becomes packed and caked at the bottom of a fire extinguisher. In addition, the fire extinguisher of the instant invention includes, in addition to a conventional gauge for indicating the pressure of propellant gases within the fire extinguisher, a type of gauge for indicating the serviceability of the temperature responsive valve actuating structure thereof.

A secondary propellant gas storage chamber is defined within the fire extinguisher of the instant invention and is in part provided to eliminate the problem of caked dry chemical powder in the bottom of the fire extinguisher from being only partially discharged upon actuation of the fire extinguisher. In addition, the secondary propellant gas pressure storage chamber further provides structure whereby an adjacent or remotely located alarm may be automatically actuated in response to an increase in ambient temperature above a predetermined temperature.

SUMMARY OF THE INVENTION

The fire extinguisher is constructed whereby it may be readily carried in the hand from one location to another without accidental discharge of the fire extinguisher. Further, the fire extinguisher includes internal structure defining a secondary propellant pressure storage chamber which coacts with the main propellant pressure storage chamber within the fire extinguisher during the time of discharge of the extinguisher to penetrate and dislodge any dry chemical powder that may be caked or packed at the bottom of the fire extinguisher. Also, the fire extinguisher includes a temperature responsive actuator for discharging the fire extinguisher automatically in addition to a conventional hand operable actuator. Still further, the sealed temperature responsive bellows assembly for automatically discharging the fire extinguisher includes reliable mechanical structure by which the operability of the automatic bellows actuator may be readily visually determined.

The main object of this invention is to provide a more reliable fire extinguisher including structure by which it may be automatically discharged against a rated fire.

Another object of this invention, in accordance with the immediately preceding object, is to provide a dry chemical fire extinguisher including internal structure operative to penetrate and dislodge any dry chemical

powder that may be packed and caked in the bottom of the fire extinguisher at the time of discharge of the latter.

A still further object of this invention is to provide a fire extinguisher having conventional structure for manually discharging the extinguisher and which is combined with further structure for automatic discharging of the fire extinguisher in response to an increase in temperature of the ambient air within a specific area.

Another object of this invention, in accordance with the preceding objects, is to provide a fire extinguisher operable to automatically sound an alarm either adjacent the fire extinguisher or remote from the fire extinguisher without adversely affecting the principal function of providing a fire extinguisher which may be automatically as well as manually actuated.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical sectional view, taken substantially upon a plane passing through the center of a fire extinguisher, constructed in accordance with the present invention and with the main valve of the extinguisher in an open position under operation of the hand operating lever;

FIG. 2 is a fragmentary, vertical sectional view, similar to the upper portion of FIG. 1, but illustrating the bellows actuator of the fire extinguisher in an operative position;

FIG. 3 is a horizontal sectional view, taken substantially upon the plane indicated by the section line 3—3 of FIG. 1;

FIG. 4 is a horizontal sectional view, taken substantially upon the plane indicated by the section line 4—4 of FIG. 2;

FIG. 5 is a vertical sectional view, similar to the FIG. 1, but with the bellows and hand lever valve actuators of the fire extinguisher in inoperative positions and with the fire extinguisher equipped with a modification whereby signals may be rendered both adjacent and remote from the fire extinguisher in response to an increase of ambient air temperature rise adjacent and remote from the fire extinguisher;

FIG. 6 is a fragmentary, vertical sectional view illustrating a modified form of discharge nozzle;

FIG. 7 is a fragmentary elevational view of the fire extinguisher as seen from the left side of FIG. 1 and illustrating the manner in which the leaf spring opposing the bellows member serves as an indicator of the sealed temperature responsive charge within the bellows member being intact;

FIG. 8 is a fragmentary, vertical sectional view illustrating the manner in which the side pressure indicating gauge is communicated with the interior of the fire extinguisher;

FIG. 9 is an enlarged side elevational view of an internal push sleeve portion of the fire extinguisher; and

FIG. 10 is a bottom plan view of the push sleeve portion.

DETAILED DESCRIPTION OF THE INVENTION

Referring now more specifically to the drawings, the numeral 10 generally designates a first form of fire extinguisher constructed in accordance with the present invention. The extinguisher 10 includes an outer pressure container 12 including cylindrical side wall portions 14 closed at their lower ends by means of an integral bottom wall 16. The upper end of the container 12 includes a diametrically reduced and internally threaded neck 18 in which an externally threaded diametrically reduced end 29 of a fitting 22 is tightly threaded, the threaded connection between the fitting 22 and the neck 18 including an O-ring seal 23. The inner end of the fitting 22 includes a threaded counterbore 24 and the portion of the fitting 22 above the upper end of the counterbore 24 includes a radial discharge port 26 provided with an internally threaded outer end counterbore 28 in which a fan pattern discharge nozzle 30 is removably threadedly engaged.

A downwardly facing conical seat 32 concentric with the counterbore 24 communicates the upper end of the latter and the lower side of the lateral discharge port 26. In addition, the fitting 22 includes an upper end bore 34 concentric with the seat 32 and which opens upwardly through the center of the upper end of the fitting 22 and downwardly into the upper side of the lateral discharge port 26 in alignment with the seat 32.

A dual concentric tube assembly referred to in general by the reference numeral 36 is provided and includes an outer tube 38 externally threaded at its upper end and threadedly engaged into the counterbore 24. The assembly 36 further includes an inner tube 40 supported from the outer tube 38 by means of longitudinal diametrically opposite spacing ribs 42.

The upper end portion of the inner tube 40 includes an inwardly projecting annular shoulder 43 and a push sleeve 44 extends through the reduced diameter opening defined by the shoulder 43 and is provided with an upper end radially outwardly projecting abutment flange 46 which bears against the shoulder 43 disposed immediately therebelow. The sleeve 44 includes a lower end inner annular seal 48 which slidably receives a tubular push rod 50 therethrough. The push rod 50 has a longitudinal blind bore 52 formed therein which extends throughout all but the lower terminal end of the push rod 50, the lower terminal end being externally threaded as at 54 and having a valve head 56 threadedly engaged thereon. The valve head 56 includes a diametrically reduced portion 58 which is snugly receivable in the lower end of the inner tube 40 and is equipped with a sealing ring 60 for forming a fluid-tight pressure seal between the valve head 56 and the internal surfaces of the lower end of the tube 40. In addition, the push rod 50 is provided with longitudinally spaced radial bores 61 for a purpose to be hereinafter more fully set forth.

A center drilled valve stem 62 defining a longitudinal bore 64 therethrough is provided and the lower end of the valve stem 62 includes a counterbore 66 in which the upper end of the push rod 50 is slidably received and equipped with an O-ring seal 68 forming a fluid pressure seal between the counterbore 66 and the external surfaces of the push rod 50. An intermediate portion of the valve stem 62 includes a conical head 70 seatable against the seat 32 and a compression spring 72 is disposed about the valve stem 62 between the

head 70 and the annular flange 46 of the push sleeve 44.

The valve stem 62 includes an upper portion which extends upwardly through the bore 34 and includes an upwardly facing circumferentially extending shoulder 74, the upper portion of the valve stem 62 being equipped with an O-ring seal 76 for forming a fluid-tight seal with the surfaces of the bore 34.

A downwardly opening cover 78 is secured over the upper end of the fitting 22 by means of removable pins 80 and diametrically opposite midportions of the cylindrical walls of the cover 78 are provided with openings 82 and 84 through which the upwardly bent end portions 86 and 88 of a centrally apertured leaf spring 90 extend. A sealed bellows assembly 92 is removably secured beneath the top wall 94 of the cover 78 as at 96 and the lower end of the bellows assembly 92 includes an annular abutment 98 through which the upper terminal end of the valve stem 82 is slidably received, the bellows assembly 92 being sealed independently of the valve stem 62. The central aperture portion of the leaf spring 90 slidably receives the upper terminal end of the valve stem 62 therethrough and the upper terminal end of the valve stem 62 includes an abutment 100 against which the underside of the central portion of the leaf spring 90 abuts.

When the cover 78 is removed by removal of the pins 80, the central apertured portion of the spring 90 and the abutment 98 are withdrawn upwardly from the upper terminal end 102 of the valve stem 62. The upper terminal end 102 is hollow and includes a Schraeder-type valve 104 therein. The valve 104 is provided in order that the interior of the inner tube 40 may be charged with a propellant gas through the rod 50, the underside of the annular flange 46 forming a fluid-tight seal with the upper surface of the annular shoulder 43.

One side wall of the fitting 22 includes a radial passage 106 formed therethrough registered with a port 108 in the upper end of the outer tube 38 and a conventional pressure gauge 110 is removably threadedly engaged in the passage 106, see FIG. 8. Also, the exterior of the cover 78 has indicia 112 and 114 thereon with the upper indicia 112 indicating the presence of an adequate supply of expandable gas under pressure within the bellows member 92 for downwardly biasing the valve stem 62 in response to a rise in ambient temperature in order that the extinguisher 10 may be actuated.

A bifurcated lever 116 is pivotally supported from the fitting 22 by means of a pivot pin 118 and the bifurcated end of the lever 116 embracingly receives the valve stem 62 therebetween above and opposes the shoulder 74. A horizontally outwardly projecting handle 120 is also supported from the fitting 22 and an actuating lever 122 is pivotally supported from the fitting 22 by means of the pivot fastener 118. One end of the actuating lever 122 is received in a window 124 formed in the cover 78 and is downwardly engageable with the lever 116 upon outward and upward swinging movement of the handle end 126 of the lever 122 from the position thereof illustrated in FIG. 2 of the drawings to the position illustrated in FIG. 1. In this manner, the inner end of the lever 122 bears downwardly upon the lever 116. This, of course, will cause the bifurcated end of the lever 116 to bear downwardly upon and downwardly displace the valve stem 62 in order to unseat the head 70 from the seat 32 for discharging the extinguisher 10.

The discharge nozzle 30 includes a central passage 130 formed therethrough and a center stem 132 extends through the passage 130 and outwardly of the outer end thereof and terminates in a bulbous head 134. The head 134 serves to break up the discharge of chemical powder passing through the passage 130 and to form a conical spray pattern thereof.

With attention now invited more specifically to FIG. 6 of the drawings, there will be seen a modified form of nozzle referred to in general by the reference numeral 136. The nozzle 136 is similar to the nozzle 30, except that the center stem 138 is considerably shorter and does not project outwardly of the outlet end of the central passage 140 corresponding to the passage 130. Although the outer end of the stem 138 includes a bulbous head 142, the head 142 is wholly received within the outer end of the passage 140 and the outer end of the passage 140 is partially closed by means of an end wall portion 144 having a small diameter discharge opening 146 formed therein. Accordingly, the nozzle 136 will cause a more concentrated discharge of chemical powder to be discharged from the extinguisher 10 when the nozzle 136 is used in lieu of the nozzle 30.

With attention now invited more specifically to FIG. 5 of the drawings, there will be seen a modified form of fire extinguisher referred to in general by the reference numeral 10' and which is substantially identical in construction and operation to the fire extinguisher 10. Accordingly, the various components of the fire extinguisher 10' corresponding to similar components of the fire extinguisher 10 are designated by prime reference numerals corresponding to the reference numerals applied to the components of the fire extinguisher 10.

The only difference between the fire extinguisher 10 and the fire extinguisher 10' is that the upper end portion of the valve stem 62' of the extinguisher 10' is provided with a lateral tube 150 communicated at its inner end with the upper end of the bore 64' immediately below the Schraeder valve 104. The tube 150 passes through a suitable opening 152 provided therefor in the cover 78'. The outer end portion of the tube 150 includes an enlarged area 154 having a fusible plug (not shown) disposed therein and the outer terminal end of the tube 150 outwardly of the enlarged area 154 has a gas operated whistle or other audible signal device 156 operatively coupled thereto. In addition, the tube 150 includes a branch line 158 which may extend to a remote location and also have a fusible plug operatively associated therewith as well as an audible signal such as the whistle 156 or some other signal actuating apparatus operatively associated therewith.

In operation, when it is desired to charge the extinguisher 10, the fitting 22 is removed and the proper quantity of dry chemicals is placed into the container 12. Then, the fitting 22 is replaced and the nozzle 30 is removed so that the discharge end of a supply line of suitable propellant gas may be threadedly engaged in the counterbore 28. Then, after the interior of the container 12 has been properly charged by propellant gas while the actuating lever 122 is swung upwardly to the position thereof illustrated in FIG. 1 of the drawings so as to downwardly displace the valve head 70 from the seat 32, the lever 122 is returned to the position thereof illustrated in FIG. 2 in order to seat the head 70 against the seat 32. Thereafter, the supply line for propellant gas may be removed from the counterbore 28 and the nozzle 30 may be replaced. Then, the cover 78 is re-

moved from the fitting 22 and a lesser charge of propellant gas is admitted into the interior of the inner tube 40 through the Schraeder valve 104. Thereafter, after the cover 78 has been reinstalled, the fire extinguisher 10 may be either manually discharged by means of the lever 122 or by an increase in ambient temperature causing the bellows member 92 to expand and downwardly displace the valve stem 62. Upon downward displacement of the valve stem 62, the head 70 is unseated from the seat 32 and the valve head 56 is displaced downwardly relative to the lower end of the inner tube 40. In this manner, both propellant charges are utilized to expel the dry chemical powder from the interior of the container 12 up through the annular passage defined between the inner and outer tubes 40 and 38. Of course, the dry chemical powder is discharged through the seat 32 and the nozzle 30. As the propellant charge within the inner tube 40 passes out of the open lower end of the inner tube 40 upon downward movement of the valve head 56, it tends to dislodge any powdered chemical caked and packed in the bottom of the container 12.

AS hereinbefore set forth, the nozzle 30 is effective to discharge a divergent spray of dry chemical powder and if the nozzle 136 is utilized, a more concentrated discharge of dry chemical powder will result.

The fire extinguisher 10' operates in substantially the same manner, except that the fire extinguisher 10' is also capable of rendering an audible signal through the utilization of the propellant charge within the inner tube 40' in the event the ambient temperature adjacent the extinguisher 10' rises above a predetermined temperature or the ambient temperature at a remote location rises above a predetermined temperature. Of course, the temperature at which the fusible plugs will melt is to be set at a temperature below that which would cause sufficient expansion of the bellows member 92' to downwardly displace the valve stem 62' sufficiently to cause the head 70' to move away from the seat 32'.

Upon actuation of the lever 122 toward the position thereof illustrated in FIG. 1, the valve head 70 is first moved away from seat 32. Then, the shoulder defined by the inner end of the bore 66 contacts the upper end of push rod 50 and downwardly displaces the latter. Subsequently, after sufficient downward displacement of the push rod 50, the O-ring 60 carried by the valve head 56 is displaced downwardly from the lower end of the inner tube 40, the opening of the valve head at the lower end of tube 40 being on the order of one-sixteenth inch and the opening of the valve head 70 being on the order of one-fourth inch.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. In combination, a pressure container having an upper outlet opening, an upstanding double tube assembly disposed within said container including inner and outer tube members, said outer tube member having its upper end supported in sealed relation to said outlet, valve means operable to selectively open and

close said outlet and including means for selectively opening and closing the lower end of said inner tube, the lower ends of said tubes being spaced above the bottom of said container, the space between the outer tube and the inner surfaces of said container including a lower portion for receiving dry chemicals and an upper portion for containing propellant gases under pressure, the space between the inner and outer tubes defining an outlet passageway for said dry chemicals and extending upwardly toward and communicated with said outlet, and the interior of said inner tube defining a pressure chamber for containing a supplemental propellant gas charge.

2. The combination of claim 1 wherein said inner tube projects downwardly below the lower end of said outer tube.

3. The combination of claim 1 wherein said outlet includes a fitting closing said outlet and having an upstanding downwardly opening bore formed therein including a lower end counterbore in which the upper end of said outer tube is sealingly secured.

4. The combination of claim 3 wherein said valve includes a portion thereof operatively associated with said bore for opening and closing the latter.

5. The combination of claim 4 wherein the lower end portion of said bore defines a downwardly opening valve seat, said valve including an upstanding valve stem supported for vertical shifting relative to said seat and including an enlarged head portion seatingly engageable with said seat.

6. The combination of claim 1 wherein said valve includes a manual actuator therefor operable from the exterior of said container.

7. The combination of claim 6 including a second heat responsive actuator for said valve disposed exteriorly of said container operable to open said valve in response to the ambient temperature being increased above a predetermined level.

8. The combination of claim 6 wherein said outlet in-

cludes a fitting closing said outlet and having an upstanding downwardly opening bore formed therein including a lower end counterbore in which the upper end of said outer tube is sealingly secured, said valve being operatively associated with said bore for opening and closing the latter, the lower end portion of said bore defining a downwardly opening valve seat, said valve including an upstanding valve stem supported for vertical shifting relative to said seat and including an enlarged head portion seatingly engageable with said seat.

9. The combination of claim 8 wherein said heat responsive actuator comprises a sealed bellows member, a bowed leaf spring biasing said bellows member away from the upper end of said stem against the pressure therein, whereby should said bellows member develop a leak it will collapse, said spring including at least one exposed end portion whereby collapsing of said bellows member and the resultant flexing of said spring will result in a visual change in the attitude of said one end of said spring.

10. The combination of claim 9 wherein said stem includes a central passage closed at its upper end and communicated with the interior of said inner tube at its lower end, the upper end of said stem including an inlet valve structure comprising the closure for the upper end of said passage and by which the interior of said inner tube may be charged, a small diameter tube having one end communicated with the interior of said passage below the upper end of said stem, the other end of said small diameter tube being disposed exteriorly of said container and adapted to be closed by a fusible member having a melting point below the temperature required to enable said bellows member to downwardly shift said valve stem.

11. The combination of claim 1 wherein an upper portion of said container includes a stationary out-

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