

Feb. 21, 1961

F. B. ALLEN ET AL

2,972,466

DISCHARGE HEAD

Filed Aug. 9, 1957

2 Sheets-Sheet 1

Fig. 2.

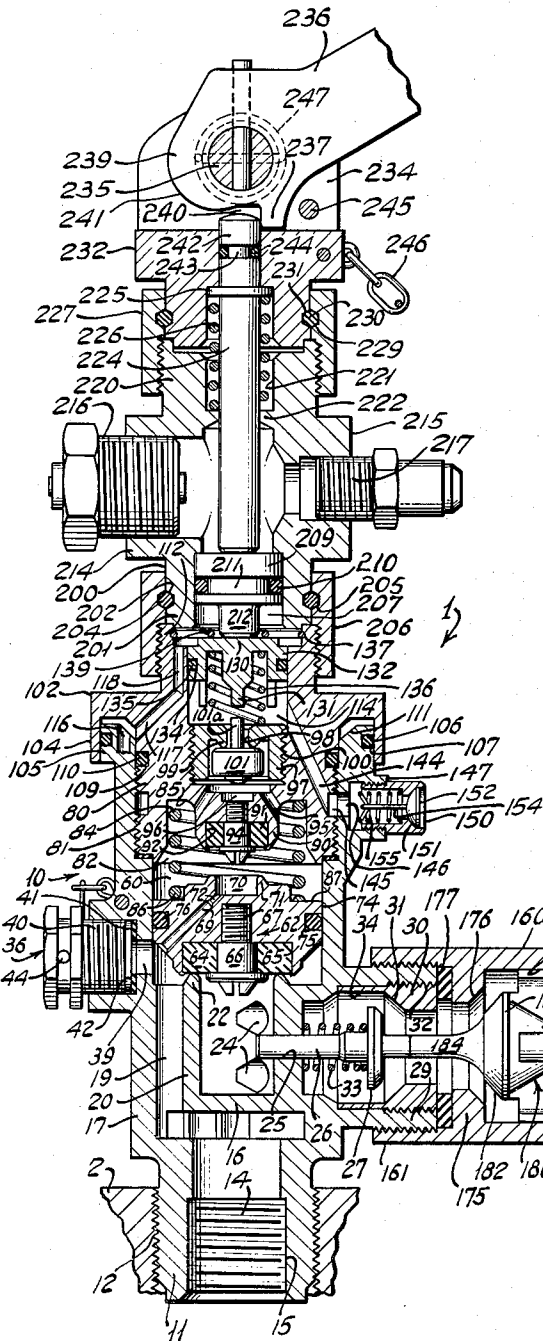
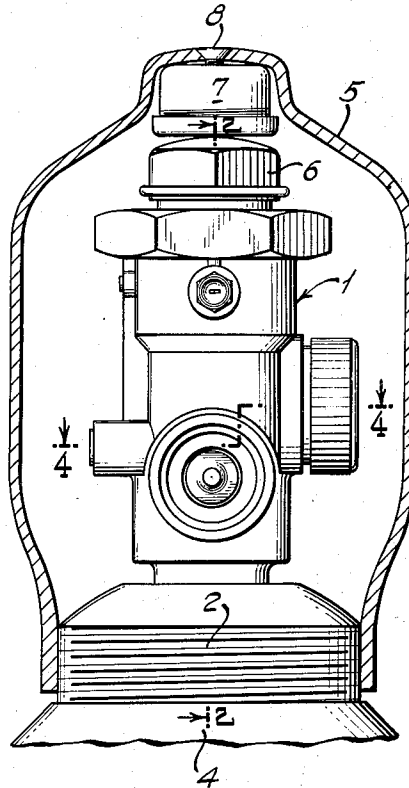


Fig. 1.



INVENTORS
FRANK B. ALLEN
WALTER M. HESSLER
BY
Edward R. Thomas
ATTORNEY

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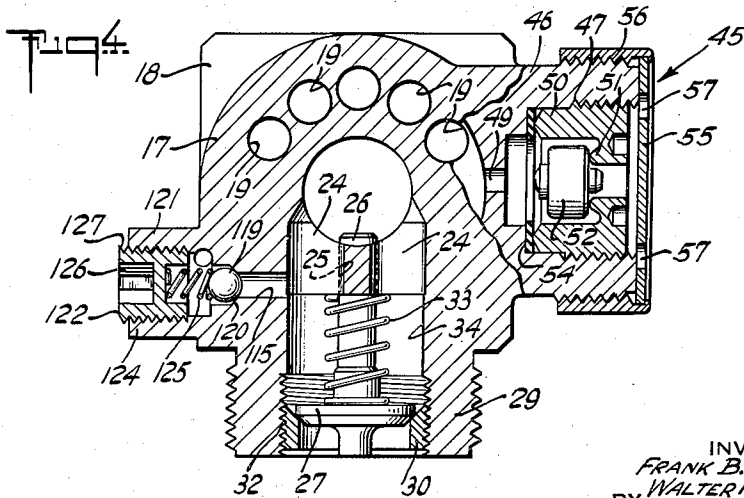
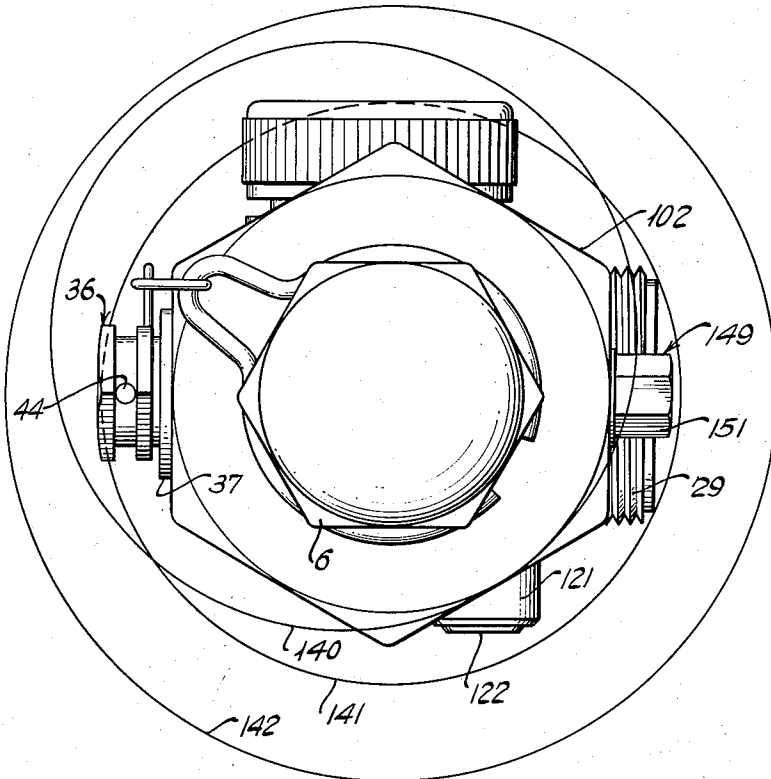
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2 Sheets-Sheet 2

Fig. 3.



INVENTORS
FRANK B. ALLEN
WALTER M. HAESSLER
BY *Edward V. Connor*
ATTORNEY

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2,972,466

DISCHARGE HEAD

Frank B. Allen, Towaco, and Walter M. Haessler, Chatham, N.J., assignors to The Fyr-Fyter Company, Dayton, Ohio

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3 Claims. (Cl. 251—35)

The present invention relates to an improved discharge head suitable for use on high pressure fire extinguishing agent containers.

The discharge head in accordance with the present invention is an improvement over that shown in Allen et al. Patents 1,827,723 and 2,051,589.

It is important that a discharge head for fire extinguishing fluid have a high flow rate because a given quantity of fire extinguishing agent is most effective if it is rapidly applied to a fire. It is also important that the valve member of the discharge head be pressure sealed by stored medium so as to insure against leaks upon a pressure rise of the stored fluid. In order to quickly open the valve of the discharge head with a minimum of equipment, a construction generally is provided in which energy of the stored fluid is used. Furthermore, the discharge head must be compact, so that if attached to a conventional high pressure fluid container, a standard protective cap may be installed over at least the valve portion of the discharge head in position on the container during transportation thereof.

In the Allen patents referred to above, the discharge head passage is closed by a frangible disc which is ruptured by a puncturing member, which may be actuated manually or by pressure operation, the pressure of released fluid being utilized to assure complete rupture of the disc. While the Allen discharge heads have been generally satisfactory, in some installations a complex and unwieldy mechanical system has been required to provide the initial force to rupture the disc with the puncturing member. Further, the disc must be replaced before the container may be recharged.

The present invention aims to overcome the foregoing difficulties and disadvantages and to meet the foregoing requirements by providing a discharge head for a high pressure container several of which are connected together to provide a bank of containers. In the discharge head the discharge passage is closed by a main valve member normally held on its seat by the pressure in the container acting against a piston, pilot valve means actuable by a small force being provided to release the pressure behind the piston so that pressure on the face of the piston moves the main valve away from its seat and simultaneously closes off a passage leading fluid behind the piston so that the main valve member is pneumatically held in the open position by pressure against the face of the piston until the discharge is completed, the released pressure being utilized to hold the pilot valve open to insure an effective opening operation.

The discharge head in accordance with the invention is of the type that may be attached to a container of fifty pounds of carbon dioxide and produces a discharge rate such that a container so equipped is rated by the Underwriters Laboratories as equally effective as a container of one hundred pounds of carbon dioxide using prior discharge heads, the advantageous rating being ob-

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tained by reason of the high discharge rate. However, by reason of the high discharge rate, safety means must be incorporated into the discharge head so that there can be no accidental discharge during transportation or installation of a container fitted with the discharge head as the high discharge rate would cause the container to rocket wildly about possibly causing injury to persons or damage to adjacent equipment. Furthermore, by reason of the fact that a container fitted with the discharge head may be subjected to sub-zero temperatures with the consequent drop in pressure for pressure operation means are incorporated to assist or supplement pressure operation of the discharge head.

Another object of the invention is to provide an improved high pressure discharge head which is simple and economical in manufacture, efficient in operation and durable in use.

Other objects and advantages of the invention will be apparent from the following description and from the accompanying drawings which show, by way of example, an embodiment of the invention.

In the drawings:

Figure 1 is an elevational view of the discharge head in accordance with the invention in position on a high pressure container (shown broken away) with a portion of its control mechanism removed and a protective cylinder cap (shown in section) in position.

Figure 2 is a sectional view taken along the line 2—2 of Figure 1 but additionally showing control mechanism in position.

Figure 3 is a top plan view of the discharge head with circles indicating the various positions of the open mouth of the protective cap as it is placed over the discharge head into the position of Figure 1.

Figure 4 is a sectional view taken along the line 4—4 of Figure 1.

Referring to the drawings, there is shown in Figure 1 a discharge head 1 attached to the neck 2 of a high pressure fluid container 4 shown broken away. A protective cap 5 is positioned about the discharge head 1 which is shown the its upper portion removed and with a cap member 6 in position protecting the exposed end of the container. A spare parts box 7 is positioned in the inner end of the protective cap 5 secured in position by a screw 8, the spare parts box 7 being adapted to receive replacement gaskets, valve members, etc.

In Figure 2 the complete discharge head 1 is shown in vertical section and includes a generally vertically extending housing 10, the lower end 11 thereof exteriorly threaded as indicated at 12 for engagement with neck 2 of the container 4, the discharge head thereby closing the outlet of the container 4. At the lower end 11 of the housing 10 is a vertically extending inlet passage 14 threaded as indicated at 15 to receive the threaded upper end of a conventional syphon tube, not shown. Across the inlet passage 14 is a partition member 16 extending across the width of the inlet 14, however, by-pass means around the partition member 16 are provided by enlarging the housing 10 as indicated at 17, a square portion 18 being provided to facilitate engagement by a tool, the enlarged portion thereby providing a vertically extending fluid passage 19. An upwardly directed tubular extension 20 for the partition member 16 forms the wall of the by-pass passage 19, or an alternative construction is preferably used (see Figure 4) in which the tubular extension 20 is made integral with the housing, a plurality of vertically extending passages 21 forming the by-pass 19 being bored or otherwise made therein. At the top of the tubular extension 20 is a main valve seat 22 formed with a conventional rounded edge to receive a valve member. The side wall of the tubular extension 20 is apertured as indicated at 24 there-

by forming outlet fluid passage means. The tubular extension 20 is further apertured to form a guideway 25 which is adapted to slideably receive a guiding extension 26 for a safety check 27. About the safety check 27 is an outlet boss 29 in fluid communication with the outlet passages 24. On the outer end of the outlet boss 29 is a ring-shaped seat member 30 providing a safety check seat 31 adapted to be engaged by the safety check 27, a spring 33 being provided to abut between the outer surface of the tubular extension 20 and the inner surface of the safety check 27 normally urging the check valve 30 against its seat 31. The seat member 30 is threadedly engaged in the inner surface of the outlet boss 29 as indicated at 32. The cross-sectional areas of the bypass 19, the valve seat 22, the outlet 24, and space 34 between the outer edge of the safety check 27 and the seat member 30 are at least as great as the area of the inlet fluid passage 14.

A conventional safety assembly 36 is engaged in a boss 37 about a fluid passage 39 in fluid communication with the inlet portion of the discharge head at the upper end of the by-pass 19, the safety disc assembly is threadedly engaged in the boss 37 as indicated at 40 and is sealed by a gasket 41, a rupturable sealing disc 42 normally closes the sealing disc 42. The sealing disc 42 is rupturable upon a pressure rise to a predetermined amount thereby venting the high pressure fluid through a plurality of opposed recoil prevention openings 44.

A filling assembly 45 is positioned on the housing 10 approximately at right angles to the sealing disc assembly 36 and is threadedly engaged in a filling boss 46 as indicated at 47, the filling boss 46 is positioned about a fluid passage 49 in fluid communication with the bypass 19 of the inlet portion of the discharge head. The filling assembly 45 includes a ring nut 50 having a filling valve seat 51 formed therein engaged by a filling valve member 52. A gasket 54 seals against leaks. In order to protect the filling assembly, a cap member 55 may be threadedly engaged with the filling boss 46 as indicated at 56, the cap member 55 being made with vent apertures 57.

A cylinder 60 is formed in an enlarged portion of the housing 10 to receive a piston valve member 62 having on its lower face a main valve contacting member 64 adapted to engage the main valve seat 22, the diameter of the piston valve member 62 being greater than the axial length thereof. The main valve contacting member 64 is made of any suitable material well-known in the art and may be apertured and secured in position in a recess 65 by a screw member 66 threadedly engaged in the body of the piston valve member 62 as indicated at 67. A bleed fluid passage 69 extends from the lower end of the piston valve member 62 outwardly of the valve member 64 upwardly adjacent the center of the piston valve member 62 terminating in a recess 70. The outer edge of the recess 70 is provided with a bleed fluid valve seat 71. In order to predetermined the rate of flow through the bleed fluid passage 69, the upper end thereof as indicated at 72 is of reduced diameter rather than making the entire length of the fluid passage 69 of the same diameter so as to prevent the possibility of freeze-up, frictional losses, and to provide less chance of clogging of the reduced portion of the passage. The piston valve member 62 is slideably guided against the wall of the cylinder 60 by side wall 74, a gasket recess 75 being provided to receive an O-ring gasket 76. It should be noted that the axial length of the side wall 74 is extremely short relative to the diameter of the piston valve member 62, however, by reason of the equal distribution of the pressures acting on the piston valve member, there is no tendency for it to cock and become jammed in the cylinder. This construction of the piston valve member 60 is very important in that it permits the use of a considerably shorter housing than heretofore used.

The housing 10 at its upper end 77 receives an end wall member 80 closing the upper end of the cylinder 60, the end wall 80 being threadedly engaged with the inner wall of the housing as indicated at 81. The end wall 80 is recessed on its under surface as indicated at 82 to receive a spring 84 abutting at its upper end 85 against the bottom of the recess 82 and abutting at its lower end 86 against upper end 87 of the piston valve member 62.

In order to provide means for closing the bleed fluid passage 69, a downwardly directed bleed valve member 90 is positioned on the lower end of the end wall member 80 and provided with valve seat contacting material 91 apertured and secured in position in a recess 92 by means of a screw 94.

To vent fluid from behind the piston valve member 62, a plurality of vent passages 95 are provided extending from the under side of the end wall member 80 to a recess 96 formed in the upper portion thereof. A partition member 97 apertured as indicated at 98 having a vent valve seat 99 on its inner side is threadedly engaged with the wall of the recess as indicated at 100 to receive a vent valve member 101 having a stem 101a, the vent valve member 101, the downwardly directed bleed passage valve member 94 and the main valve member 64 being all in coaxial alignment with the center line of the inlet passage 14.

The end wall member 80 is provided with a flange 102 having a downwardly directed portion 104 adapted to overlie a flange 105 of the housing upper end 77. Sealing means is provided by an O-ring gasket 106 received in a gasket recess 107. Another gasket recess 109 is adapted to receive an O-ring 110 to complete the seal for the housing upper end 77, the end 77 having its end surface cut away at an angle to provide an annular fluid passage 111. On the upper end of the end wall member 80 is a tubular extension 112 forming a back pressure cylinder 114, fluid passage means for the seat back pressure cylinder 114 being provided from the outlet 24 through a horizontal passage 115, a vertical passage 116, the annular passage 111, a diagonal passage 117, and a vertical passage 118, the back pressure fluid passage being provided with a ball check valve 119 and a ball check valve seat 120 placed at the intersection of the passages 115 and 116. In order to maintain the ball check in position so as to permit fluid flow from the outlet 24, but to prevent fluid flow in the reverse direction, the check valve seat 120 is placed about the passage 115 facing outwardly. A boss 121 is adapted to receive a nut 122 having a spring recess 124 on the inner end thereof to force a spring 125 into engagement with the ball check 119. The outer end of the recessed nut 122 may be formed with an opening 126 to receive a tool to secure the nut in position by threaded engagement as indicated at 127 with the inner surface of the boss 121.

Within the back pressure cylinder 114 a back pressure piston 130, having a downwardly depending operating rod 131 on the lower surface thereof, is slideably guided in the cylinder 114 by side wall 132 having a recess 134 to receive an O-ring sealing gasket 135. A spring 136 is engaged between the upper surface of the partition member 97 and the lower surface of the back pressure piston 130 to normally urge the back pressure piston 130 in the upper direction so that the operating rod 131 is clear of the vent valve member stem 101a. In order to retain the control piston 130 in its cylinder 114, the inner surface of the end of the cylinder wall is grooved as indicated at 137 to receive a retaining member 139.

Venting means for the underside of the back pressure piston 130 are provided by means of a fluid passage 144 leading to an annular groove 145 formed about the lower end of the end wall 80. The annular groove 145 is so positioned that when the end wall member 80 is inserted in position, the annular groove 145 is in alignment with a fluid passage 146 extending through upper end 77 of

the housing 10. A boss 147 is positioned about the end of the passage 146 and is adapted to threadedly receive a check assembly 149, having a shoulder 150 with a valve seat 151 on its outer surface to receive a sector-shaped valve member 152.

The valve member 152 has an inwardly directed extension 154 to engage the inner end of a spring 155 abutting at its other end against the shoulder 150 adapted to hold the sector shaped valve member on its seat. This assembly permits the outward passage of fluid released by operation of the vent valve member 101 or back pressure behind the piston 130. However, the valve member 152 prevents the entry of water or moisture into the various operating parts of the discharge head. It should be noted that the size of the passage 144 is such as to adequately relieve pressure vented behind the piston 130 so that the piston 130 may be readily moved downward by the pressure of fluid from the outlet transmitted to the top thereof through passages 115, 116, 111, and 118. The outer surface of the tubular extension 112 is threaded to receive the cap member 6 during transportation of the container with the discharge head attached and with the protective cap 5 in position.

The construction so far described is that shown in Figure 1 included within the protective cap 5. The construction of the improved discharge head has been made such that it would fit within a standard sized protective cap 5 which has a 3-inch opening to engage the 3-inch diameter of the neck 2 of standard cylinders. In order to place the protective cap 5 in position over the construction so far described, it is necessary to move the cap member 5 around so that its opening may pass over the various bosses extending from the housing; Figure 3 is illustrated with circles 140 and 141 showing the position of the mouth of the protective cap as it is slipped over the bosses, circle 142 indicating the outer surface of the protective cap 35.

Because of the high discharge rate provided with the discharge head in accordance with the invention, it is necessary that the transportation and installation of the containers should be done in a "non-armed condition"; thus, with the construction so far described if an accidental discharge were had, the safety check valve member 27 would prevent fluid flow from the outlets 24.

An arming connector is attached to an end of a flexible bend which provides the connection between the discharge head and the header of the usual fire extinguishing system. The arming connector includes a tubular member 160 having one end 161 adapted to overlie and threadedly engaged with the outlet boss 29. The other end 162 of the tubular member 160 is connected through ball swivel means with a fitting 165 at the end of a flexible bend 166. The swivel means is provided by a plurality of balls 167 engaged in cooperating grooves 169 and 170. Inner end 171 of the fitting 165 is sealed by an O-ring gasket 172 in a gasket recess 174. The end 161 has a shoulder 175 provided with a valve seat 176 on the inner face thereof. A gasket 177 provides a seal between the outer side of the shoulder 175 and the end of the boss 29.

Within the tubular member 160 is an arming member 180 having an enlarged portion 181 with a valve member surface 182 on one side thereof. Extending beyond the valve seat is an arming rod 184, the arming rod being of a length so that when the arming connector is in position on the outlet boss 29, both the check valve 27 and the valve member 182 are unseated. On the opposite end of the arming member 180 from the arming rod 184 is a plurality of vane guiding members preferably four in number equally spaced and each having a flanged portion 185 with a sector shoe 186 having an outer surface of a radius to conform to that of the inner surface 187 of the tubular member 160, the inner surface 187 together with the sector shoe 186 forming guiding means for the arming member 180. It should be noted that the surface of the arming member 180 is

streamlined in the direction of flow from the arming rod 184 past the valve member 182 and thence along a back surface 189 so that the resistance to fluid flow is a minimum.

So far described the discharge head would be operative on one of the slave containers of a bank of containers connected together, the operation of the discharge head taking place by back pressure entering through the flexible bend 166 and actuating the back pressure piston 130. However, in such a bank of containers it is necessary that one, and preferably two containers be provided with means to initiate a discharge whereby the slave container may be discharged by back pressure. The discharge heads for the control containers include means for the opening of the main valve 90 positioned at the top of the vertically extending housing 10 after the cap member 6 has been removed.

The control means includes a tubular member 200 having its lower end 201 provided with a recess 202 to receive a swivel ring 204, the swivel ring being engaged in a cooperating recess 205 in a ring nut 206 threadedly engaged with end 112 of the housing 10. Space 207 within the tubular member 200 acts as a cylinder for the reciprocation of a piston 209 sealed with an O-ring 210 in a gasket recess 211. An operating rod 212 at the bottom of the piston 211 is adapted to contact the back pressure piston 130.

Approximately in the middle of the tubular member 200 is a boss 214 at one side and another boss 215 opposite thereto. The boss 214 is adapted to receive a standard pressure leak check assembly 216, which may be alternatively replaced by a conventional electric discharge plug, not shown. The boss 215 is fitted with a connector 217 which may lead to a source of pressure releasable in any conventional manner, or alternatively may be closed with a plug when the electric discharge plug is used in the boss 214, or still in another construction both the pressure connection means and the electric discharge plug may act on the piston 211.

At the upper end of the tubular member 200 is a boss 220 having a passage 221 therethrough with a reduced portion 222 serving as a guideway for a manual operating rod 224. The manual operating rod 224 is formed with a shoulder 225 receiving a spring 226 in abutment therewith and with the shoulder 222, the spring 226 normally urging the operating rod 224 upwardly out of contact with the piston 211. The exterior of the boss 220 is threaded to receive an annular flange nut 227 having a recess 229 to receive a swivel ring 230 also engaged in a cooperating recess 231 of a fitting 232 carrying on its upper surface a pair of upwardly directed extensions 234 apertured to receive a pin 235 providing pivot means for a manual operating handle 236.

The manual operating handle 236 is provided with a stop 237 and a cam surface 239 providing clearance as indicated at 240 for the normal inoperative position. An enlarged portion 241 of the cam is adapted, upon the rotation thereof to contact end 242 of the operating rod 224 for its downward movement. The upper end of the operating rod 224 is grooved to provide a gasket recess 243 adapted to receive an O-ring gasket 244.

A locking pin 245 is inserted in an aperture through the upwardly directed extensions 234 so as to normally prevent the operation of the handle 236 until the safety pin is first removed. A chain 246 is provided to prevent the loss of the safety pin after it has been removed. In order to maintain the operating handle 236 in non-operative position, a spring 247 is provided secured between the pivot pin 235 and the operating handle 236 in a conventional manner.

In the operation of the discharge head, pressure may be admitted to the piston 211 through pressurizing fitting 217 or by means of the actuation of an electric discharge plug positioned in the boss 214. In the event the pressure is insufficient to move the piston 211 downwardly,

assistance may be had by operation of the manual operating handle 236 or, alternatively, the actuation of the piston 211 downwardly may be had solely by movement of the operating handle 236. The downward movement of the piston 211 moves back pressure piston 130 downwardly in contact with the stem of the vent valve member 101 thereby releasing fluid through passages 95 from the space in back of the piston valve member 62. The pressure of fluid in the by-pass 19 on the face of piston valve member 62 moves it upwardly against the action of the spring 84 and causes seating of the bleed valve member 91 on the bleed valve seat 71, thus, preventing further flow of fluid through the passages 69 and 72 to the rear of the piston.

The piston valve member 90 is pneumatically locked in the open position by pressure of fluid on the face thereof irrespective of whether or not the vent valve member 101 is maintained in the open position, the force of the spring 84 being predetermined so that the piston valve member 62 will remain in the open position until the pressure within the inlet 14 drops to a desired value when substantially all of the contents of the container 4 have been evacuated. After a discharge the container 4 may be refilled with fire extinguishing agent through the filling assembly 45 through which fluid will flow inwardly down through by-pass 19 and inlet passage 14 into container 4. At the same time fluid will flow through the bleed passages 69 and 72 behind the piston valve member 62 urging the main valve member 64 against its seat 22.

While the invention has been described and illustrated with respect to a specific embodiment thereof, it will be understood that other embodiments may be resorted to without departing from the invention. Therefore, the form of the invention set out above should be considered as illustrative and not as limiting the scope of the following claims:

We claim:

1. A discharge head for use with a high pressure fluid container, the discharge head comprising a generally vertically extending housing, the lower end of the housing adapted to close the outlet of a high pressure container with which it is used, the lower end of the housing having a vertically extending inlet fluid passage, a partition member extending across the passage, the upper portion of the housing enlarged in diameter thereby providing fluid passage means by-passing said partition member, said by-pass passage offset from the inlet passage, an upwardly directed tubular extension for the partition member in alignment with the inlet passage, the exterior of the tubular extension with the inner wall of the enlarged portion of the housing defining said fluid passage by-pass, a main valve seat formed at the upper edge of the tubular extension, the main valve seat in alignment with the inlet passage, the sidewall of the tubular extension aperture forming outlet fluid passage means, a horizontal extension for the housing defining an outlet boss in fluid communication with the outlet passage, a piston valve member carrying a main valve seat contacting member at the lower end thereof and adapted to engage the main valve seat, the diameter of the piston valve member greater than the axial length thereof, the inner wall of the housing above the main valve seat forming a main cylinder receiving the piston valve member, bleed fluid passage means extending from the lower end of the piston valve member outwardly of the main valve seat contacting member to the upper end of the piston valve member, a bleed valve seat about the upper end of said bleed fluid passage on said piston valve member, an end wall member closing the upper end of the main cylinder, a downwardly directed bleed valve member positioned on said end wall member and adapted to be contacted by said bleed passage valve seat to close the bleed passage, the end wall having a recess therein in its upper portion, an apertured partition member closing the recess, vent fluid passage means

extending through said end wall member from the lower end thereof outwardly of said bleed valve member to the recess, a vent valve seat about the aperture on the lower side of the recess partition member, and a vent valve member positioned in said recess and adapted to engage the vent valve seat, the main valve member, the bleed passage valve member and the vent valve member being in coaxial alignment with the center line of the inlet passage, whereby the vent valve member may be unseated so that pressure may be vented behind the piston and the main valve opened by pressure on the face of the piston and the bleed valve passage is closed to prevent loss of fluid therethrough.

2. A discharge head for use with a high pressure fluid container, the discharge head comprising a generally vertically extending housing, the lower end of the housing adapted to close the outlet of a high pressure container with which it is used, the lower end of the housing having a vertically extending inlet fluid passage, a partition member extending across the passage, the upper portion of the housing enlarged in diameter thereby providing fluid passage means by-passing said partition member, said by-pass passage offset from the inlet passage, an upwardly directed tubular extension for the partition member in alignment with the inlet passage, the exterior of the tubular extension with the inner wall of the enlarged portion of the housing defining said fluid passage by-pass, a main valve seat formed at the upper edge of the tubular extension, the main valve seat in alignment with the inlet passage, the sidewall of the tubular extension apertured forming outlet fluid passage means, a horizontal extension for the housing defining an outlet boss in fluid communication with the outlet passage, a pair of horizontal extensions for the housing in fluid communication with the outlet passage, one of the pair of extensions defining a safety disc plug boss and the other of the pair of extensions defining a filling connection boss, a piston valve member carrying a main valve seat contacting member at the lower end thereof and adapted to engage the main valve seat, the diameter of the piston valve member greater than the axial length thereof, the inner wall of the housing above the main valve seat forming a main cylinder receiving the piston valve member, bleed fluid passage means extending from the lower end of the piston valve member outwardly of the main valve seat contacting member to the upper end of the piston valve member, a bleed valve seat about the upper end of said bleed fluid passage on said piston valve member, an end wall member closing the upper end of the main cylinder, a downwardly directed bleed valve member positioned on said end wall member and adapted to be contacted by said bleed passage valve seat to close the bleed passage, the end wall having a recess therein in its upper portion, an apertured partition member closing the recess, vent fluid passage means extending through said end wall member from the lower end thereof outwardly of said bleed valve member to the recess, a vent valve seat about the aperture on the lower side of the recess partition member, and a vent valve member positioned in said recess and adapted to engage the vent valve seat, the main valve member, the bleed passage valve member and the vent valve member being in coaxial alignment with the center line of the inlet passage, whereby the vent valve member may be unseated so that pressure may be vented behind the piston and the main valve opened by pressure on the face of the piston and the bleed valve passage is closed to prevent loss of fluid therethrough.

3. A discharge head for use with a high pressure fluid container, the discharge head comprising a generally vertically extending housing, the lower end of the housing adapted to close the outlet of a high pressure container with which it is used, the lower end of the housing having a vertically extending inlet fluid passage, a partition member extending across the passage, the upper portion of the housing enlarged in diameter thereby pro-

viding fluid passage means by-passing said partition member, an upwardly directed tubular extension for the partition member, the exterior of the tubular extension with the inner wall of the enlarged portion of the housing defining said fluid passage by-pass, a main valve seat formed at the upper edge of the tubular extension and defining inlet and outlet portions of the passage, a horizontal extension for the housing defining an outlet boss in fluid communication with the outlet passage, a piston valve member carrying a main valve seat contacting member at the lower end thereof and adapted to engage the main valve seat, the diameter of the piston valve member greater than the axial length thereof, the inner wall of the housing above the main valve seat forming a main cylinder receiving the piston valve member, bleed fluid passage means extending from the lower end of the piston valve member outwardly of the main valve seat contacting member to the upper end of the piston valve member, an extension for the piston valve member, a bleed valve seat on the piston valve member extension about the upper end of said bleed fluid passage, an end wall member closing the upper end of the main cylinder, a downwardly depending extension for the end wall member, a downwardly directed bleed valve member positioned on said end wall member extension and adapted to be contacted by said bleed passage valve seat to close the bleed passage, the end wall having a recess therein in its upper portion, an apertured partition member closing the recess, vent fluid passage means extending through

said end wall member from the lower end thereof to the recess, a vent valve seat about the aperture on the lower side of the recess partition member, and a vent valve member positioned in said recess and adapted to engage the vent valve seat, a spring urging the piston valve member in main valve seat engaging position, the spring having one end overlying the piston valve member extension, the other end of the spring overlying the end wall extension, the main valve member and the vent valve member being in coaxial alignment with the center line of the inlet passage, whereby the vent valve member may be unseated so that pressure may be vented behind the piston and the main valve opened by pressure on the face of the piston.

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