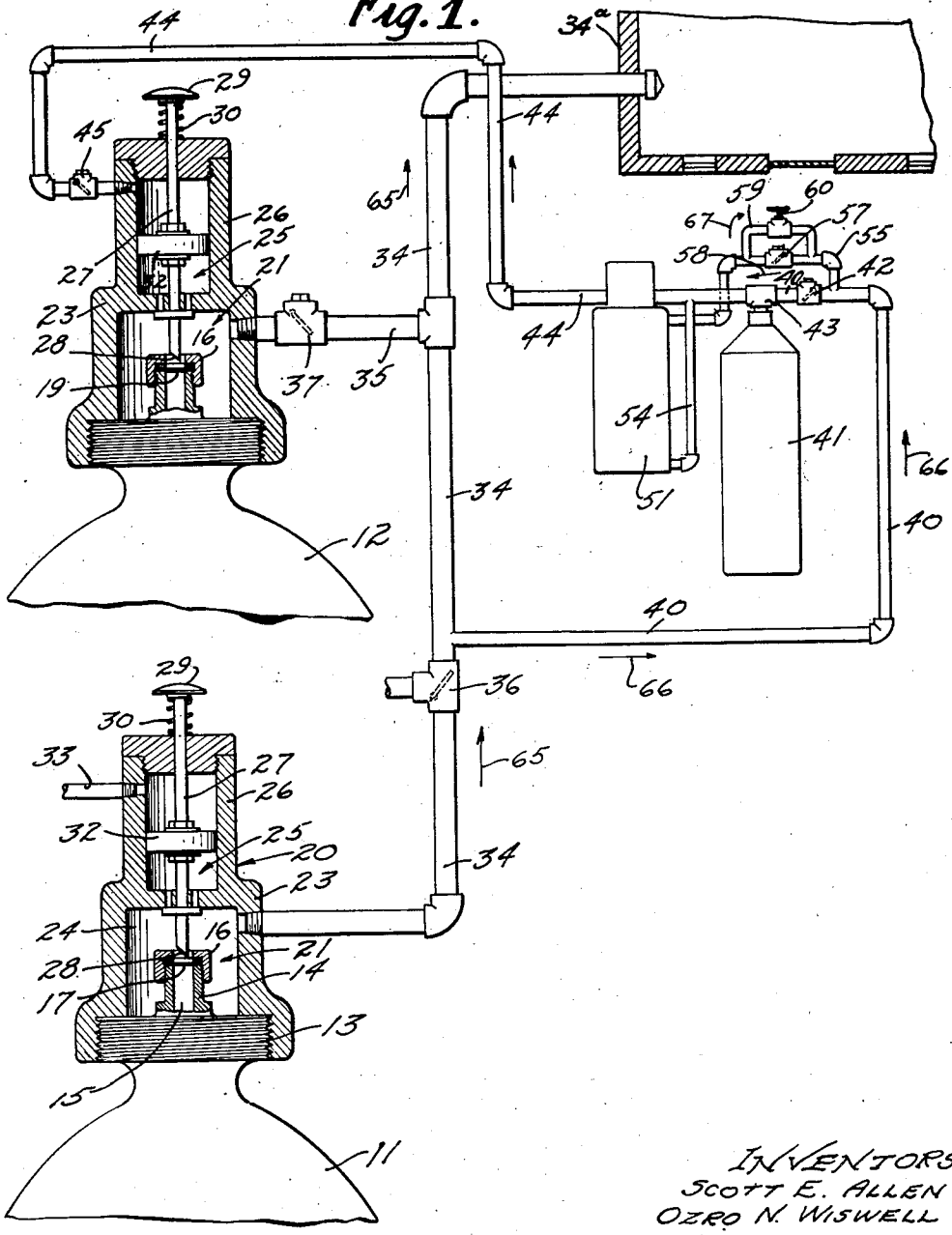
Aug. 14, 1934. S. E. ALLEN ET AL 1,969,869

STAGE DISCHARGE OF PRESSURE CYLINDER

Filed July 30, 1927 2 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

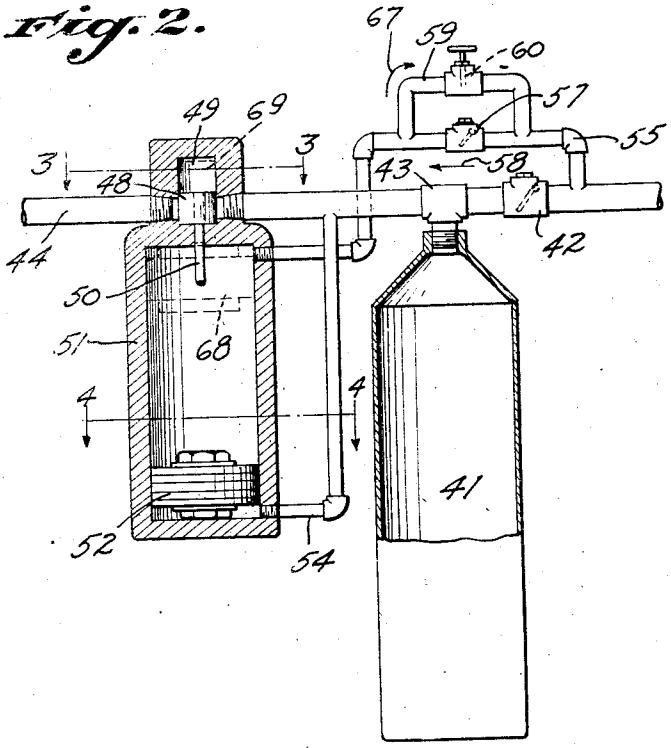


Fig. 3.

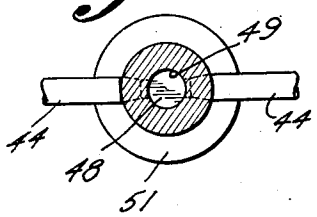
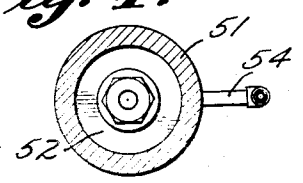


Fig. 4.



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STAGE DISCHARGE OF PRESSURE CYLINDER

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Application July 30, 1927, Serial No. 209,534

12 Claims. (Cl. 169—11)

Our invention relates to apparatus for releasing a compressed medium from its container. In the following description the invention will be described in connection with fire extinguishing apparatus, this application of the invention being of commercial importance. There is on the market at the present time fire extinguishing apparatus which releases inert gas such as CO_2 into contact with the burning parts. The carbon dioxide or CO_2 has notable fire extinguishing qualities and will almost immediately put the fire out.

It is sometimes advantageous to release one charge of carbon dioxide and a short time thereafter to release a second charge.

It is an object of this invention to provide an apparatus for releasing a fluid from its receptacles in which one stage is first released and a second stage is released after a lapse of a certain period of time.

It is an object of the invention to provide a novel form of timing means for releasing the fluid of the second stage a certain period of time after releasing the fluid of the first stage.

A further object of the invention is to provide an apparatus of this character in which the timing means is operated by the fluid pressure of the first stage.

Other objects and advantages of the invention will be made evident in the following description.

Referring to the accompanying drawings in which the invention is illustrated:

Fig. 1 is a diagrammatic view illustrating the invention, certain parts being shown in section.

Fig. 2 is an enlarged view partly sectioned showing the timing means of the invention.

Fig. 3 is a section taken on the line 3—3 of Fig. 2.

Fig. 4 is a section taken on the line 4—4 of Fig. 2.

Referring to Fig. 1, the numeral 11 designates a primary receptacle and the numeral 12 designates a secondary receptacle. The primary and secondary receptacles may be of any design, those shown being the ordinary carbon dioxide bottle. These receptacles 11 and 12 have threaded neck portions 13 from which projections 14 extend, these projections 14 having discharge openings 15 formed therethrough. Caps 16 are screwed onto the outer ends of the projections 14. The cap 16 of the primary receptacle 11 retains a primary fluid retaining means in the form of a closure plate 17 in place over the opening 15 of receptacle 11; and the cap 16 of the secondary receptacle retains a secondary fluid retaining means in the form of a closure plate 19 in place over the opening 15 of receptacle 12. The receptacles 11 and 12 are provided with operating means for opening the closure plates, the receptacle 11 being provided with a primary operating means indicated by the numeral 20 and the receptacle 12 being operated by a secondary operating means indicated by the numeral 21. These primary and secondary means 20 and 21 may be substantially identical in construction. In the case illustrated each of the means 20 and 21 is made as follows:

Screwed onto the threaded portion 13 is a body 23 which forms a chamber 24 around the projections 14, the cap 16, and the closure plate which is held by the cap. The upper part of the body 23 is in the form of a cylinder 26 through which a penetrating member, in the form of a plunger 27, extends. The lower end of the plunger is located in the chamber 24 immediately above the closure plate and is provided with a point 28 whereby the plate may be penetrated upon downward movement of the plunger 27. At the upper end of the plunger 27 above the body 23 there is a handle or knob 29 and compressed between the handle and the upper end of the body 23 is a compression spring 30 which yieldingly holds the plunger in upper position. The plunger may be manually forced downward to penetrate the plate by percussing the handle 29. Secured to the plunger 27 in the cylinder 26 is a piston 32.

Connected to the upper part of the cylinder 26 of the primary receptacle 11 is a pressure supply pipe 33, by means of which a fluid under pressure may be introduced into the cylinder to move the piston 32 downward, thus puncturing the closure plate 17.

Connected to the chamber 24 of the primary receptacle 11 is a delivery means in the form of a delivery pipe 34. It is to be understood that the delivery pipe may extend to any desired space or location, say, for instance, to a chamber 34^a protected by the apparatus. In practice, the chamber 34^a is usually a room or like compartment having a door, windows, or other parts allowing limited escape of gas. Connected to the chamber 24 of the secondary receptacle 12 is a branch delivery pipe 35 which is also connected to the delivery pipe 34. The delivery pipe 34 has a check valve 36 in it for preventing a reverse flow therethrough, that is, flow from the secondary receptacle to the primary receptacle. The branch delivery pipe 35 has a check valve 37 in it for preventing a reverse flow therethrough, that is, flow from the pipe 34 into the secondary receptacle.

Connected to the delivery line 34 is a primary

fluid conduit 40 which is connected to the upper part of a reservoir 41. The primary fluid conduit 40 is provided with a check valve 42 adjacent to the reservoir 41 which prevents a reverse flow therethrough, that is, a flow from the reservoir 41 to the delivery pipe 34. Connected to the reservoir 41, preferably by means of a T fitting 43 which also connects the primary fluid conduit 40 therethrough, is a secondary fluid conduit 44 which, as shown, is connected to the upper part of the cylinder 26 of the secondary receptacle 12. There is a check valve 45 provided in the secondary fluid conduit adjacent to the cylinder 26 allowing fluid to enter the cylinder from the conduit. The secondary fluid conduit 44 is closed by means of a plunger valve 48 which operates in a chamber 49 which is included in the secondary fluid conduit 44. The plunger valve 48 has a stem 50 which projects downward into a cylinder 51. Adapted to move in the cylinder 51 is a valve operator in the form of a piston 52. The lower end of the cylinder 51 is connected to the reservoir 41 by means of a conduit 54. In the drawings the pipe 54 is shown as connected to the reservoir 41 by means of that portion of the secondary fluid conduit 44 between the chamber 49 and the T fitting 43. If desired, the pipe 54 may be connected directly to the reservoir 41. The upper part of the cylinder 51 is connected by a pipe 55 to the primary fluid conduit 40 between the check valve 42 and the delivery pipe 34. The pipe 55 has a check valve 57 for preventing a flow therethrough opposite to that indicated by the arrow 58. A return by-pass pipe 59 is connected to the pipe 55 on each side of the check valve 57 and is provided with a needle valve or leak valve 60 for controlling a leakage flow around the check valve 57.

In the operation of the invention the closure plate 17 is broken either by manually operating the plunger 27 of the operating means 20 or by automatically or manually causing a fluid under pressure to be supplied through the pressure supply pipe 33 to the upper part of the cylinder 26 of the means 20. When the closure plate 17 is broken, fluid under pressure will pass from the receptacle 11 through the delivery pipe 34 in the direction indicated by arrows 65. A portion of this fluid passes through the primary fluid conduit 40 as indicated by arrows 66 and fills the reservoir 41. The fluid also passes through the pipe 55 and fills the upper part of the cylinder 51. The piston 52 will not move at this time in view of the fact that the pressure on both sides thereof is equal. The valve 48 is at this time in the closed position as illustrated in the drawings, and there will be no flow of fluid through the secondary fluid conduit 44. When the pressure of the fluid released from the primary receptacle 11 into the delivery pipe 34 decreases as a result of the fluid being discharged from the pipe 34 at the desired location, the check valves 42 and 57 will close, thus retaining the fluid pressure in the reservoir 41. When the pressure in the primary fluid conduit 40 on the right side of the check valve 42 decreases below the pressure in the cylinder 51, there will be a flow of fluid around the check valve 57 and through the return by-pass 59 as indicated by the arrow 67. At this time an unbalance of pressure exists in the cylinder 51, and the pressure of the fluid in the reservoir 41 causes the piston 52 to move upward. By the time the piston 52 reaches the position indicated by dotted lines 68 of Fig. 2 the stem 50 has been engaged and raised so that the valve 48 is raised in the chamber 49 into the position indicated by dotted lines 69. At this time the secondary fluid conduit is opened and the fluid under pressure in the reservoir 41 passes through this secondary fluid conduit 44 and into the cylinder 26 of the means 21. The pressure of this fluid from the reservoir 41 is sufficient to depress the piston 32 and the plunger 27 of the means so that the closure plate 19 of receptacle 12 is penetrated. This permits the fluid of this secondary receptacle 12 to pass into the chamber 24, through the branch delivery pipe 35, and into the delivery pipe 34.

The amount of time between the discharge of the primary receptacle and the discharge of the secondary receptacle is controlled by adjusting the needle valve 60. If the needle valve 60 is adjusted for a very small flow, the time will be quite long; however, if it is adjusted for a substantial flow, the period of time in which the piston 52 will rise and engage the stem 50 will be rather small.

In the drawings and in this description the reservoir 41 is filled by the fluid of the primary receptacle 11. This is not essential to the invention and this fluid in the reservoir 41 may be supplied by other means. We have shown the primary and secondary stages as each including a single receptacle, but it should be understood that each stage may include a number of receptacles and more stages may be provided if desired.

Having described only a typical preferred form of our invention, we do not wish to limit ourselves to the specific details set forth, but wish to reserve to ourselves any changes or variations that may appear to those skilled in the art or fall within the scope of the following claims:

We claim as our invention:

1. In combination: a primary receptacle carrying a fluid under pressure; primary fluid retaining means for retaining said fluid in said receptacle; a delivery means into which said fluid is delivered when it is released; a secondary receptacle carrying a fluid under pressure; a secondary fluid retaining means for retaining said fluid in said secondary receptacle; primary operating means for operating said primary fluid retaining means in a manner to release the fluid from said primary receptacle; secondary fluid-operated means for operating said secondary fluid retaining means in order to release fluid from said secondary receptacle; a reservoir; a primary fluid conduit connected to said delivery means and to said reservoir; a secondary fluid conduit connected to said reservoir and said secondary fluid-operated means; a valve adapted to close said secondary fluid conduit; and timing means for opening said valve in predetermined time relation to the release of fluid from the primary receptacle.

2. In combination: a primary receptacle carrying a fluid under pressure; primary fluid retaining means for retaining said fluid in said receptacle; a delivery means into which said fluid is delivered when it is released; a secondary receptacle carrying a fluid under pressure; a secondary fluid retaining means for retaining said fluid in said secondary receptacle; primary operating means for operating said primary fluid retaining means in a manner to release the fluid from said primary receptacle; secondary fluid-operated means for operating said secondary fluid retaining means in order to release fluid from said secondary receptacle; a reservoir; a primary fluid conduit connected to said delivery

means and to said reservoir; a secondary fluid conduit connected to said reservoir and said secondary fluid-operated means; a valve adapted to close said secondary fluid conduit; a cylinder; a piston operable in said cylinder to open said valve; and means for moving said piston in said cylinder when the fluid pressure in said delivery means decreases.

3. In combination: a primary receptacle carrying a fluid under pressure; primary fluid retaining means for retaining said fluid in said receptacle; a delivery means into which said fluid is delivered when it is released; a secondary receptacle carrying a fluid under pressure; a secondary fluid retaining means for retaining said fluid in said secondary receptacle; primary operating means for operating said primary fluid retaining means in a manner to release the fluid from said primary receptacle; secondary fluid-operated means for operating said secondary fluid retaining means in order to release fluid from said secondary receptacle; a reservoir; a primary fluid conduit connected to said delivery means and to said reservoir; a secondary fluid conduit connected to said reservoir and said secondary fluid-operated means; a valve adapted to close said secondary fluid conduit; a cylinder; a piston in said cylinder operable to open said valve upon a drop in pressure in the top of the cylinder; a pipe connected to the lower part of said cylinder and to said reservoir; a pipe connected to the top of said cylinder and to said primary fluid conduit; a check valve in said primary fluid conduit between said reservoir and the point where said second-named pipe connects to said primary fluid conduit to allow fluid to enter the reservoir; a check valve in said second-named pipe to allow fluid to enter the top of the cylinder; a by-pass around said check valve in said second-named pipe and of less fluid capacity than the second-named pipe.

4. In combination, a primary receptacle carrying a fluid under pressure, primary fluid retaining means for retaining said fluid in said receptacle, a delivery means into which said fluid is delivered when it is released, a secondary receptacle carrying a fluid under pressure, a secondary fluid retaining means for retaining said fluid in said secondary receptacle, primary operating means for operating said primary fluid retaining means in a manner to release the fluid from said primary receptacle, secondary fluid-operated means for operating said secondary fluid retaining means in order to release fluid from said secondary receptacle, a reservoir, a primary fluid conduit connected to said delivery means and to said reservoir, a secondary fluid conduit connected to said reservoir and said secondary fluid-operated means, a valve adapted to close said secondary fluid conduit, a cylinder, a piston operable in said cylinder to open said valve, a pipe connected to the lower part of said cylinder and to said reservoir, a pipe connected to the top of said cylinder and to said primary fluid conduit, a check valve in said primary fluid conduit between said reservoir and the point where said second-named pipe connects to said primary fluid conduit operable to pass fluid to the reservoir, a check valve in said second-named pipe operable to pass fluid to the top of the cylinder, and a by-pass around the check valve of said second-named pipe.

5. In combination, a primary and a secondary receptacle for containing fluid under pressure, each receptacle having only a single normal discharge opening, and control means for controlling the discharge of the fluid from both receptacles, including means for timing the discharge of the secondary receptacle with relation to the discharge of the primary receptacle, and means for regulating the timing means.

6. In combination, a pair of containers for fluid under pressure, means for discharging one of the containers, means controlled thereby for causing the subsequent discharge of the other receptacle after a predetermined time interval, and means for varying said time interval.

7. In combination, a pair of containers for fluid under pressure, each container having a single normal discharge opening, a frangible closure member for each of said openings, means for rupturing each frangible member, and control means for controlling the operation of the rupturing means, including means for timing the rupturing of one of the frangible members with relation to the rupturing of the other frangible member and means for regulating the timing means.

8. In combination, an enclosure to be protected and from which gas has limited egress, a plurality of containers carrying a supply of fire-extinguishing gas, means for discharging a predetermined initial charge of said gas into the enclosure to establish a fire-extinguishing atmosphere therein, and a control put into operation upon the first mentioned means being operated for discharging another charge of said gas into the enclosure at a predetermined time after the initial charge enters the enclosure to maintain a fire-extinguishing atmosphere in the enclosure.

9. In combination, a plurality of receptacles holding fluid under pressure and each having a discharge means, fluid pressure control means in connection with each receptacle for controlling the discharge of fluid therefrom, a fluid conduit establishing communication between the discharge means of one of the receptacles and the control means of the other receptacle whereby the discharge of fluid through said conduit will operate the latter control means, said conduit including a control valve and pressure responsive means operated by pressure of fluid in said conduit for operating the valve in response to a predetermined drop in pressure of the fluid acting on said pressure responsive means, and means to delay the operation of the valve upon drop of such pressure.

10. In combination, a pair of receptacles holding fluid under pressure and each having discharge means, fluid pressure control means in connection with each receptacle for controlling the discharge of fluid therefrom, a fluid conduit establishing communication between the discharge means of one of the receptacles and the control means of the other receptacle whereby the discharge of fluid through said conduit will operate the latter control means, said conduit including a control valve and pressure responsive means operated by pressure of fluid in said conduit comprising a cylinder and a piston operative in said cylinder for opening the valve in response to a predetermined drop in pressure of the fluid in the cylinder, and means to delay the operation of said valve upon drop of such pressure.

11. In combination, a plurality of receptacles holding fluid under pressure and each having a discharge means, fluid pressure control means in connection with each receptacle for controlling the discharge of fluid therefrom, a fluid conduit establishing communication between the discharge

means of one of the receptacles and the control means of the other receptacle whereby the discharge of fluid through said conduit will operate the latter control means, a control valve in said conduit operated by a drop of pressure in the conduit, and means to delay operation of said valve upon the drop of such pressure.

12. A system for extinguishing fire in an enclosure from which gas has limited egress, said system including a pair of containers each holding fire extinguishing gas under pressure, discharging means for discharging gas from said containers and delivering the same into said enclosure, and a controller for initiating operation of the discharging means, each container having a discharge port and a frangible member normally sealing the port, said discharging means including devices operable to rupture the frangible members and means controlling the discharge of the containers whereby delivery of gas into the enclosure will flow from one of the containers after the pressure of gas from the other of the containers has fallen below a predetermined value.

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