

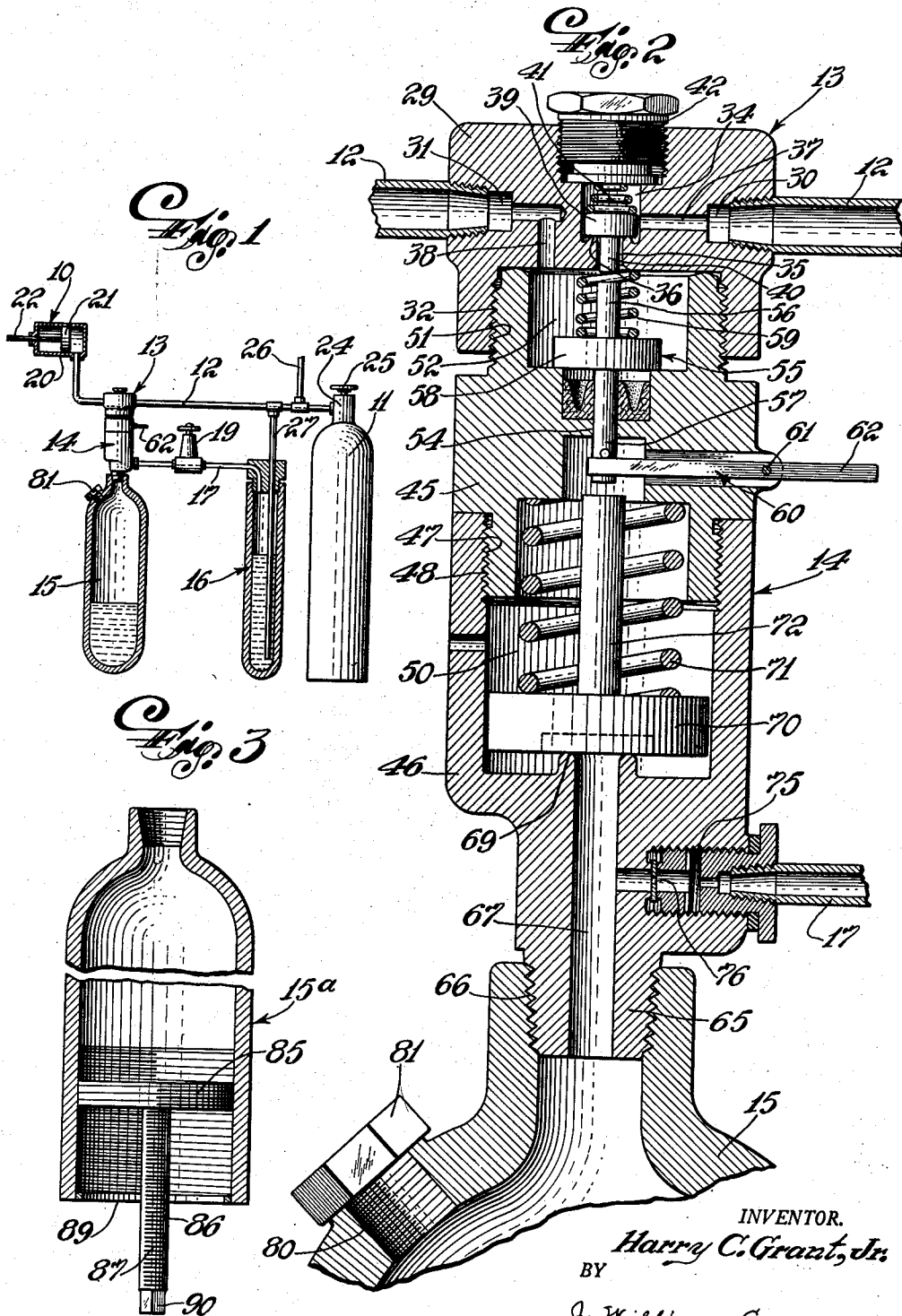
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H. C. GRANT, JR

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FLUID MEDIUM OPERATED TIME DELAY APPARATUS

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INVENTOR.
Harry C. Grant, Jr.
BY
J. William Carson
ATTORNEY

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FLUID MEDIUM OPERATED TIME DELAY APPARATUS

Harry C. Grant, Jr., Ridgewood, N. J., assignor
to Specialties Development Corporation, Belle-
ville, N. J., a corporation of New Jersey

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The present invention relates to fluid medium operated apparatus for controlling the actuation of a pressure operated device, which in turn may be utilized to operate a valve, latch, switch or the like, and, more particularly, to such apparatus for delaying the operation of the device for a predetermined interval of time.

The present invention is primarily concerned with such time delay apparatus for use in connection with fire extinguishing systems and the like utilizing a liquefied gas such as carbon dioxide as the fire extinguishing medium and as the time delay apparatus operating medium. In using such system to extinguish fires in a compartment or enclosure, it is customary to delay the discharge of the fire extinguishing medium into the enclosure for a sufficient duration to enable the occupants thereof to escape, while giving warning that the system is being operated. However, it will be appreciated that the apparatus in accordance with the invention can be utilized for many other purposes.

One of the difficulties encountered in connection with operating such time delay apparatus by means of carbon dioxide is that liquid carbon dioxide or gaseous carbon dioxide under certain conditions of temperature and pressure, if permitted to expand, is converted at least partially into carbon dioxide snow or ice, which obstructs the passages through which the carbon dioxide is being directed and results in failure or faulty operation of the apparatus. This problem arises in most every instance where carbon dioxide is bled or caused to pass through restricted passages, such as orifices, pressure regulators and the like, and is then permitted to expand.

Accordingly, an object of the present invention is to provide time delay apparatus which is not subject to the foregoing difficulty.

Another object is to provide such apparatus wherein a source of liquid and/or gaseous carbon dioxide under any pressure and temperature conditions may be utilized as the initial operating medium by conditioning carbon dioxide from the source to supply gaseous carbon dioxide at a pressure at which it will not freeze upon further expansion thereof, regardless of its temperature.

Another object is to provide such apparatus wherein carbon dioxide gas or the like is supplied at a constant predetermined pressure and at a constant predetermined rate to effect delayed operation, after a predetermined interval of time.

Another object is to provide such apparatus wherein the pressure and the rate of flow of the

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gas supplied can be conveniently regulated or preadjusted.

Another object is to provide such apparatus wherein the gas supplied is collected in a receptacle of a predetermined effective volume, the time required to fill the receptacle with gas at a predetermined pressure determining the interval of delay.

Another object is to provide such apparatus wherein the effective volume of the aforementioned receptacle may be readily varied to adjust the interval of delay.

Another object is to provide a pressure operated time delay control head having means for manually effecting operation thereof.

A further object is to provide pressure operated time delay apparatus which is simple and economical in construction, is readily installed, and is effective in operation.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawing, forming a part of the specification, wherein:

Fig. 1 is a schematic view of apparatus in accordance with the present invention.

Fig. 2 is an enlarged longitudinal sectional view illustrating a control head embodied in the apparatus.

Fig. 3 is a fragmentary longitudinal sectional view of a receptacle for receiving fluid medium adapted to operate the control head, the receptacle being provided with another form of means for varying the effective volume thereof.

Referring to the drawing in detail and more particularly to Fig. 1 thereof, there is shown time delay apparatus generally comprising a fluid medium operated device 10, a container 11 for storing fluid medium under pressure, such as liquefied carbon dioxide, a conduit 12 connecting the device to the container, a valve 13 in the conduit between the device and the container, pressure operated means, such as a control head 14, for actuating the valve 13, a receptacle 15 in fluid flow connection with the control head, a second receptacle 16 in fluid flow connection with the conduit between the container and the valve actuated by the control head, a second conduit 17

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establishing fluid flow communication between the two receptacles, and flow restricting means, such as a pressure regulator 19, in the conduit 17.

The fluid medium operated device 10 is shown, by way of example, as a cylinder 20 having a piston 21 therein adapted to be actuated by fluid medium in the conduit 12 to operate a valve, switch or other mechanism (not shown) by means of a piston rod 22 connected thereto.

The container 11 in which the fluid medium is stored is of conventional construction and is provided with a valve 24 for releasing liquefied gas therefrom and admitting the same into the conduit 12. Any suitable means for operating this valve may be provided, a hand-wheel 25 being shown for purposes of illustration. However, it will be appreciated that a great variety of well known operating means could be utilized, including manually, electrically, hydraulically or pneumatically, locally or remotely, controllable devices.

In using the present apparatus in connection with a fire extinguishing system, the container 11 may be part of the fire extinguishing medium source of such system, and the major portion of its contents may be discharged through a conduit 26 connected to the conduit 12, the conduit 26 having a valve (not shown) therein, which is under the control of the device 10.

The receptacle 16 serves as a means for preventing liquefied carbon dioxide or the like from passing through the regulator 19, and, for this purpose, a tube 27 connected to the conduit 12 extends to the lower end of the receptacle, and the conduit 17 is connected to the upper end of the receptacle, whereby liquefied carbon dioxide delivered to the lower end of the receptacle is adapted to be converted into gaseous carbon dioxide, and only the gaseous carbon dioxide leaves the receptacle by way of the conduit 17.

The regulator 19 may be of any conventional design; hence the details thereof need not be illustrated. Where the present apparatus is used in connection with carbon dioxide, the regulator preferably is adjusted to maintain a discharge pressure on the order of about 125 pounds per square inch, which is slightly below the pressure that would exist in a liquefied carbon dioxide storage system at -40°F .

Referring now to Fig. 2, the valve 13 has a body 29 provided with an inlet 30 and an outlet 31 for connection in the conduit 12, an interiorly threaded cylindrical lower end portion 32 forming a chamber, a valve chamber 34, a valve port 35 formed with a seat 36 connecting the valve chamber to the lower end chamber, and passages 37 and 38 for respectively connecting the inlet to the valve chamber and the outlet to the lower end chamber.

A valve member 39 is positioned in the valve chamber and has a stem 40 extending downwardly through the port 35. One end of a spring 41 engages the valve member 39 and urges the same on its seat, and the other end of the spring engages a plug 42, which is screw threaded into the valve body for adjusting the force the spring exerts on the valve member.

The control head 14 comprises upper and lower body members 45 and 46 having screw threaded secured cylindrical portions 47 and 48, respectively, which cooperate to provide a chamber or cylinder 50 for a piston about to be described.

The upper control head body member 45 has an exteriorly threaded cylindrical upper end portion 51 cooperating with the portion 32 of the

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valve body to provide a chamber 52, and has a central aperture 54, which extends from the piston chamber 50 to the chamber 52.

A plunger 55 has an upper stem 56 for engaging the valve member stem 40, a lower stem 57 extending through the aperture 54 into the piston chamber 50, and an intermediate flange 58 normally seated by a spring 59 on the bottom of the chamber 52. The plunger is adapted to be moved upwardly to cause the valve member 39 to be unseated upon operation of the piston about to be described, and is also adapted to be moved upwardly by means of a lever 60 pivotally mounted on the upper control head body member at 61 and having an arm 62 extending to the exterior for manual or automatic operation thereof.

The lower control head body member 46 has a lower plug portion 65, which is screw threaded for securement into a neck opening 66 of the receptacle 15, and the plug portion is formed with a bore 67 for establishing fluid flow communication between the receptacle and the piston chamber 50. The bottom of the chamber 50 has a raised seat 69 surrounding the bore 67, the purpose of which will be made apparent hereinafter.

A loosely fitting piston 70 is disposed in the chamber 50 and is normally held against the seat 69 by a spring 71. The piston has an upwardly extending stem 72 for engaging the plunger 55 to cause the latter to unseat the valve member 39 upon upward movement of the piston 70 by pressure medium in the receptacle 15. The piston 70, its stem 72 and the plunger 55 in this manner provide pressure operated means for actuating the valve 14.

Fluid pressure medium is introduced into the receptacle 15 from the conduit 17 in any desired manner, for example, by a passage 75 in the lower control head body member, which provides fluid flow communication between the conduit 17 and the bore 67. This passage may be restricted by an orifice 76 of predetermined dimensions for admitting the fluid medium into the receptacle at a predetermined rate.

Consequently, by admitting pressure medium at a constant predetermined pressure and at a constant rate into a receptacle of a given volume, the time required to establish a preselected pressure within the receptacle 15 to cause operation of the piston 70 may be predetermined.

Suitable means may be provided for varying the effective volume of the receptacle 15 and thus vary the time within which the operating pressure builds up. Such means may comprise an opening 80 adjacent the neck of the receptacle, which is closed by a screw plug 81 and which may be utilized for placing into the receptacle a predetermined volume of liquid, preferably one which will not absorb gases readily, to thereby vary the effective gas containing volume of the receptacle.

In Fig. 3, another manner of accomplishing the foregoing described function is illustrated, wherein the receptacle 15a has a bottom member 85 screw threaded into the side wall of the receptacle to vary its effective volume. The bottom member may have a stem 86 depending therefrom provided with indicia 87 adapted to cooperate with the lower edge 89 of the receptacle, serving as index means, for visually indicating the adjusted volume of the receptacle. If desired, the lower end of the stem 86 may have a nut portion 90 for cooperation with a wrench or other suitable tool for rotating the stem to effect upward

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or downward movement to the bottom member 25 in adjusting the volume of the receptacle.

In utilizing the apparatus, the effective volume of the receptacle 15, the regulator 19, and the spring 41 of the control head 14 are adjusted to delay the opening of the valve port 35 for a predetermined interval of time after the container valve 24 has been opened. Prior to opening of the valve 24, the ports of the control head are in the position illustrated in Fig. 2.

In operation, the valve 24 is opened, whereby fluid medium is introduced into the receptacle 16 by way of the conduit 12 and the tube 27. Should the fluid medium be liquefied carbon dioxide or the like, the liquid is conducted to the bottom of the receptacle and is permitted to gasify and leave the upper end of the receptacle 16 by way of the conduit 17. The gaseous medium flows through the regulator and is metered into the receptacle 15 by way of the orifice 76.

As the receptacle 15 is being filled with gaseous medium, operating pressure is built up therein, which attains a predetermined value after the predetermined time interval has elapsed. When this pressure has been attained, the piston 70 is operated to cause its stem 72 to engage and raise the stem portion 57 of the plunger 55, which in turn causes its stem portion 56 to engage and raise the stem 40 of the valve member 39 and effect unseating thereof, whereby fluid medium is conducted through the conduit 12 to the device 10 to effect movement of its piston 21.

In the event that it is desired to open the valve port 35 before the delayed operation time interval has elapsed, the arm 62 of the lever 60 is moved downwardly, thereby causing the opposite end of the lever to raise the plunger 55, which in turn effects unseating of the valve member 39. It will be understood that the lever 60 may be operated manually or automatically by locally or remotely operable means.

From the foregoing description, it will be seen that the present invention provides improved fluid medium operated time delay apparatus, which is simple and economical in construction and is accurate and reliable in operation. The apparatus is readily adjusted to predetermine the time delay interval and is so constructed and arranged that freeze-ups, which would render the apparatus inoperative, cannot occur.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

I claim:

1. In fluid medium operated time delay apparatus, the combination of a conduit, a valve in said conduit for controlling the flow of fluid medium therethrough, means normally biasing said valve to a closed position, pressure operated means including a member for unclosing said valve, manually operable means for operating said member to unclose said valve, a spring for resetting said member and said manually operable means, a receptacle in fluid flow connection with said pressure operated means, a second receptacle in fluid flow connection with said conduit at the upstream side of said valve therein, and a second conduit establishing fluid flow communication between said receptacles.

2. In fluid medium operated time delay apparatus, the combination of a conduit, a valve

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in said conduit for controlling the flow of fluid medium therethrough, a spring for normally seating said valve, a receptacle, a cylinder, a piston in said cylinder, a member operable by said piston to unseat said valve, a spring for normally maintaining said member out of its valve unseating position, and means for introducing fluid medium into said receptacle and said cylinder.

3. In fluid medium operated time delay apparatus, the combination of a conduit, a valve in said conduit for controlling the flow of fluid medium therethrough, a spring for normally seating said valve, a receptacle, a cylinder, a piston in said cylinder, a member operable by said piston to unseat said valve, a spring for normally maintaining said member out of its valve unseating position, means for introducing fluid medium into said receptacle and said cylinder, and manually operable means for actuating said member to effect unseating of said valve.

4. In fluid medium operated time delay apparatus, the combination of a conduit, a valve in said conduit for controlling the flow of fluid medium therethrough, a spring for normally seating said valve, a receptacle, a cylinder, a piston in said cylinder, a member operable by said piston to unseat said valve, a spring for normally maintaining said member out of its valve unseating position, means for introducing fluid medium into said receptacle and said cylinder, manually operable means for actuating said member to effect unseating of said valve, and a spring for normally maintaining said piston out of its member operating position.

5. In fluid medium operated time delay apparatus, the combination of a conduit, a source of liquefied normally gaseous medium having an outlet connected to said conduit, a valve in said conduit for controlling the flow of fluid medium therethrough, means normally biasing said valve to a closed position, pressure operated means for unclosing said valve, a receptacle in fluid flow connection with said pressure operated means, a second receptacle for trapping liquid medium and permitting the same to gasify having an inlet for liquid medium in fluid flow connection with said conduit at the upstream side of said valve therein and having an outlet at its upper end for discharging gaseous medium therefrom, a second conduit establishing fluid flow communication between said first receptacle and the outlet of said second receptacle, and means for varying the effective volume of said first receptacle.

6. Fluid medium operated time delay apparatus comprising a container for storing liquefied normally gaseous medium under pressure having an outlet, a conduit connected to the outlet of said container, a valve in said conduit for controlling the flow of fluid medium through said conduit, means normally biasing said valve to a closed position, pressure operated means for unclosing said valve, a receptacle in fluid flow connection with said pressure operated means, a second receptacle for trapping liquid medium and permitting the same to gasify, a tube extending to the lower end of said second receptacle in fluid flow connection with said conduit between said container and said valve, a second conduit establishing fluid flow communication between said first receptacle and the upper end of said second receptacle for conducting gaseous medium to said first receptacle, flow regulating means in said second conduit, and means for

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varying the effective volume of said first receptacle.

7. In a fluid medium operated time delay apparatus, the combination of a container for storing a mixture of gaseous and liquefied gaseous medium under pressure, a conduit connected to said container, a valve in said conduit for controlling the flow of the fluid medium there-
through, means normally biasing said valve to a closed position, pressure operated means for unclosing said valve, a receptacle having a chamber for accumulating gaseous medium under pressure therein, said chamber being in fluid flow connection with said pressure operated means, a liquid trap chamber having an inlet tube extending therein from one end thereof in fluid flow connection with said conduit and having an outlet for separating gaseous medium from the mixture, and a second conduit connected to said trap chamber outlet for conducting the separated gaseous medium to said chamber.

8. Apparatus according to claim 7, wherein means are connected in said second conduit for regulating the pressure of the gaseous medium supplied to said chamber.

9. In fluid medium operated time delay apparatus, the combination of a source of liquefied normally gaseous fluid medium under pressure, a conduit connected to said source, a valve in said conduit for controlling the flow of fluid medium therethrough, a cylinder, a piston in said cylinder having means operable thereby to unseat said valve, spring means for normally seating said valve and normally preventing operation of said piston, a chamber having an inlet and an outlet, a tube in fluid flow communication

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with said conduit and extending into said chamber through its inlet for introducing liquefied fluid medium adapted to gasify in said chamber, and a second chamber having an inlet in fluid flow communication with said first chamber outlet for introducing gaseous fluid medium adapted to expand therein and having an outlet constantly in direct fluid communication with said piston cylinder whereby the gaseous medium in said second chamber upon attaining a predetermined pressure directly operates said piston in opposition to said spring means.

10. In fluid medium operated time delay apparatus, the combination of a conduit, a valve in said conduit for controlling the flow of fluid medium therethrough, a spring for normally seating said valve, a receptacle, a cylinder, a piston in said cylinder, a member operable by said piston to unseat said valve, a spring for normally maintaining said member out of its valve unseating position, a second spring for normally maintaining said piston out of its member operating position, and means for introducing fluid medium into said receptacle and said cylinder.

HARRY C. GRANT, Jr.

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