March 5, 1935. S. E. ALLEN ET AL 1,993,695

FIRE EXTINGUISHING SYSTEM

Filed May 9, 1932

Fig. 1.

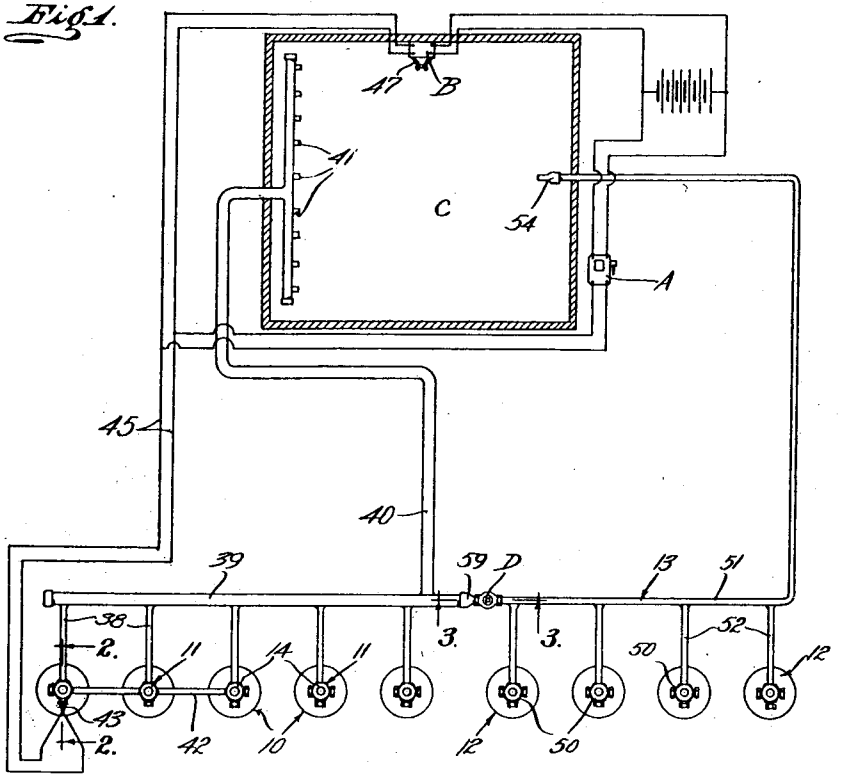


Fig. 2.

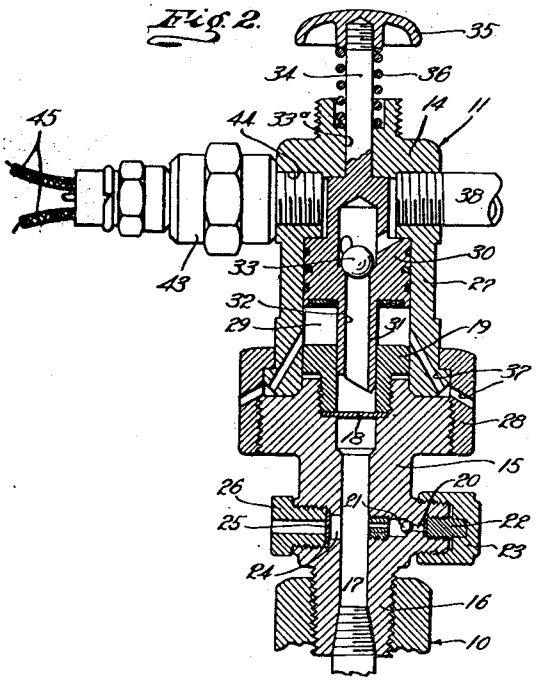
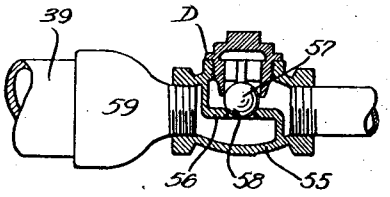


Fig. 3.



Inventors
Scott E. Allen
and
Ozro N. Wiswell
By
Their Attorney

Patented Mar. 5, 1935

1,993,695

UNITED STATES PATENT OFFICE

1,993,695

FIRE EXTINGUISHING SYSTEM

Scott E. Allen and Ozro N. Wiswell, Los Angeles, Calif., assignors to C-O-Two Fire Equipment Company, Newark, N. J., a corporation of Delaware

Application May 9, 1932, Serial No. 610,066

16 Claims. (Cl. 169—11)

This invention relates to a fire extinguishing system, and relates more particularly to a fire extinguishing system for employing carbon dioxide or a similar fire extinguishing medium. A general object of the present invention is to provide a simple, practical and dependable system operable to effectively extinguish a fire and prevent its restarting or recurrence due to smouldering, excessively hot materials, or like conditions.

Fire extinguishing systems of various characters have been introduced for employing carbon dioxide and similar fire extinguishing mediums. In most fire extinguishing systems of this character, only a single supply of the fire extinguishing medium is provided and is discharged into the compartment or zone in which the fire occurs in a single volume or charge intended to fully extinguish the fire. In numerous instances, a fire thus extinguished restarts due to smouldering materials, etc. Drafts or air currents often dissipate the fire extinguishing medium so that the fire is not fully extinguished by the single initial discharge of the extinguishing medium. Further, a latent or smouldering fire may exist for a a considerable period in the presence of the extinguishing medium and cause a recurrence of the fire.

An object of this invention is to provide a simple and effective fire extinguishing system in which an initial comparatively large volume of a fire extinguishing medium is discharged into the compartment or zone in which the fire is present to extinguish the fire, and a secondary supply of extinguishing medium is automatically released to slowly discharge into the compartment for a substantial period of time and in sufficient volume to maintain an effective fire extinguishing atmosphere in the compartment and compensate for any leakage of fire extinguishing medium from the compartment and thus prevent the recurrence or restarting of the fire.

It is another object of the invention to provide a fire extinguishing system of the character mentioned that may be actuated either manually or by remote control means controllable either manually or by suitable temperature responsive means.

It is another object of the invention to provide a fire extinguishing medium of the character mentioned in which the release of the secondary supply of fire extinguishing medium is automatically started upon discharge of the initial or principal supply of the fire extinguishing medium.

It is a further object of the invention to provide a fire extinguishing system of the character mentioned that is extremely simple and that embodies a minimum number of parts or elements.

Further objects and features of the invention will be best and more fully understood from the following detailed description of a typical form and application of the invention, in which description reference will be had to the accompanying drawing, in which:

Fig. 1 is a diagrammatic view of a typical application of the present invention. Fig. 2 is an enlarged vertical detailed sectional view of one of the discharge heads, being a view taken as indicated by line 2—2 on Fig. 1, and Fig. 3 is an enlarged detailed sectional view of the check valve, being a view taken substantially as indicated by line 3—3 on Fig. 1.

The system provided by the present invention may be varied considerably to adapt it for use in different stituations, and to protect fire hazards of various kinds. In the following detailed disclosure, I will describe a simple embodiment of the invention that may be manually actuated or actuated by remote control. It is to be understood that the invention is not to be considered as limited or restricted to the specific form or application about to be described, but it is to be taken as including any features or modifications that may fall within the scope of the claims.

The fire extinguishing system provided by the present invention, includes, generally, one or more containers 10 holding a main or principal supply of fire extinguishing medium under pressure, means 11 operable to release the main or principal supply of extinguishing medium from the containers 10 so that it passes to the enclosure or compartment C to be protected, suitable remote control means A and B for actuating the means 11, one or more containers 12 holding a secondary supply of fire extinguishing medium under pressure, and means 13 operable by the fire extinguishing medium under pressure released from the containers 10 to release the medium under pressure from the container 12 to slowly pass to the compartment C.

The containers 10 are provided to hold or carry the main supply of fire extinguishing medium to be initially discharged into the compartment C in the event of fire. The containers 10 may be in the nature of cylinders on flasks of the type commonly employed for handling carbon dioxide, or the like.

The means 11 for releasing the main supply of fire extinguishing medium from the containers

10 includes a discharge device or head 14 on the upper end of each container 10. In accordance with the broader principles of the invention, any suitable form of fluid pressure actuated releasing device or head may be provided in connection with the containers 10. Fig. 2 of the drawing illustrates in detail the head 14 on one of the containers 10. The type of discharge head illustrated in Fig. 2 is more fully described in our copending application entitled Control for discharge heads filed March 2, 1931, Serial Number 519,470.

As the several heads 14 on the containers 10 may be alike or identical, the following detailed description of the discharge head illustrated on Fig. 2 may be taken as applying to all of the heads.

The discharge head 14 may be operated manually, by fluid under pressure or by the remote control means A or B. The releasing device or discharge head 14 is mounted on the upper end of a container 10 through a typical fittting or cylinder valve 15. The cylinder valve 15 has a stem 16 threaded into the upper end of the containers 10 in the usual manner. A central longitudinal fluid passage 17 is provided in the cylinder valve 15 and is closed at its upper end by frangible closure disc 18. The frangible disc 18 is retained in position by a tubular nut 19 threaded into the uper end of the fluid passage 17. A filling opening or port 20 communicates with the fluid passage 17 and is normally closed by check valve 21. A threaded and washered plug 22 is screw threaded in the outer end of the filling opening 20 and is normally covered by cap 23. A safety discharge port 24 communicates with the fluid passage 17 and is closed by safety closure disc 25 designed to burst or fail at a predetermined high pressure. A tubular nut 26 clamps the safety closure disc 25 in position.

The discharge head 14 includes a body 27 seated on the upper end of the cylinder valve 15. A collar or coupling 28 is screw-threaded on the enlarged upper end of the cylinder valve 15 and holds the body 27 in place. A central chamber or cylinder opening 29 extends upwardly in the body 27 from its lower end and slidably carries a piston or plunger 30. The plunger 30 is provided at its lower end with a downwardly projecting cutter 31 operable to pierce or cut out the frangible closure disc 18. The lower end of the cutter 31 is inclined and sharpened to effectively cut through the closure disc 18 upon actuation of the plunger 30. An opening 32 extends longitudinally through the cutter 31 and plunger 30 and communicates with the upper end of the cylinder opening 20 at the upper end of the plunger. A check valve 33 is operable to prevent the flow of fluid downwardly through the passage 32 and to permit the discharge of fluid outwardly through the passage to the upper end of the cylinder opening. A stem 34 is provided on the upper end of the plunger 30 and extends through an opening 33^a in the wall of the body 27. A manually engageable cap 35 is provided on the projecting upper end of the stem 34. A spring 36 is arranged under compression between the upper end of the body 27 and the cap 35 to normally yieldingly hold the plunger 30 in the unactuated position illustrated in Fig. 2 of the drawing. Suitable ports 37 may be provided in the body 27 and coupling 28 to permit the escape of air from the lower end of the cylinder opening 29 upon actuation of the piston 30.

A conduit 38 communicates with the upper end of the cylinder opening 29 to carry off the released fire extinguishing medium when the plunger 30 is operated downwardly to cause the cutter 31 to cut out the closure disc 18. The conduits 38 of the several heads 14 discharge into a single header or manifold. A pipe or conduit 40 extends from the manifold 39 to the interior of the compartment C where it is provided with suitable nozzles or outlets 41. The depression of the plunger 30 of a discharge head 14 causes the fire extinguishing medium under pressure in the container 10 on which the head is arranged to be discharged through the conduit 38 into the manifold 39. The fire extinguishing medium under pressure thus released from one of the containers 10 flows through the manifold 39 and the several conduits 38 to cause the actuation of the pistons 30 of the other discharge heads 14 so that all of the heads 14 are actuated to release the fire extinguishing medium from the several containers 10. To insure the proper actuation of the discharge heads 14 by fluid pressure, interconnecting conduits 42 may connect the cylinder openings 29 of the adjoining discharge heads 14. In the particular case illustrated in the drawings, inter-connections 42 connect the cylinder openings 29 of the discharge heads 14 on the three adjoining containers 10 at one end of the series of containers.

The remote control means A and B are provided to actuate one of the discharge heads 14 to cause the main supply of fire extinguishing medium under pressure to be discharged into the compartment C. The means A and B are both controlled or actuated from a point remote from the discharge heads 14. It will be apparent that the remote control or actuating means A and B may be varied considerably in character and operation. In the particular embodiment of the invention illustrated in the drawing, the remotely controlled or actuated means A and B are operable to actuate an electrically controlled actuating device 43 on one of the discharge heads 14. The electrically controlled actuated device 43 is preferably arranged on a discharge head 14 having an inter-connection 42 with an adjoining discharge head. In the specific embodiment illustrated in the drawing, the actuating device 43 is provided on the discharge head 14 of an end container 10 which discharge head is operatively inter-connected with the discharge head 14 of the adjoining container by a conduit 42.

The electrically controlled actuating device 43 may be of the general type fully described and claimed in our copending application entitled Electrically controlled actuating device, Serial Number 448,673, filed April 30, 1930. The device 43 is in the nature of a hollow plug threaded into an opening 44 communicating with the upper end of the cylinder opening 29. The device 43 contains a highly inflammable or explosive material that is adapted to be ignited upon the passage of current through conductors 45 entering the outer end of the device.

The means A is operable to complete an electrical actuating circuit for igniting the charge or explosive in the actuating device 43. The means A is in the nature of a manually operable switch arranged in the actuating circuit 45 of the explosive device 43. The manual control switch A may be located at any suitable point, for example, a point adjacent to and exterior of the compartment C, and is normally open. It will be apparent how closing of the switch A causes ignition of the charge in the explosive device 43, which creates a pressure in the upper end of

the cylinder opening 29 to actuate the plunger 30.

The remote control means B is in the nature of a thermostatic or temperature responsive means operable upon the occurrence of high temperatures in the compartment C to complete the energizing circuit 45. The means B consists of a suitable thermostatic or temperature responsive switch 47, arranged within the compartment C, closing of the switch 47 upon a predetermined high temperature occurring in the compartment C causes the explosive charge in the actuating device 43 to be ignited so that the plunger 30 of the discharge head is operated downwardly to cut out the closure disc 18. The main or principal supply of fire extinguishing medium contained in the cylinders 10 may be released either manually by depressing the cap 35 of one of the heads 14, by manually closing the switch A, or by the automatic closing of the thermostatic switch B. The fire extinguishing medium released from the several containers 10 is free to flow through the manifold 39 and conduit 40 to discharge into the enclosure or compartment C.

The cylinders or containers 12 are provided to hold a secondary supply of fire extinguishing medium under pressure. There may be any suitable number of containers 12 as will be subsequently described, and the containers 12 are preferably located adjacent to the containers 10. In the particular case illustrated in the drawing, there are four like containers 12 for holding the secondary supply of fire extinguishing medium. Discharge heads 50 are provided on the containers 12 and are operable to release fire extinguishing medium from the containers. The discharge heads 50 may be similar to or identical with the discharge heads 14 described above.

The means 13 for automatically releasing the fire extinguishing medium from the containers 12 and for slowly discharging it into the compartment is operable to utilize the pressure of the main supply of fire extinguishing medium discharged from the containers 10 to actuate the discharge heads 50. The means 13 includes a conduit 51 with the discharge line for conducting the fire extinguishing medium from the containers 10 to the compartment. In the form of the invention illustrated in the drawing, the conduit 51 is connected with the header or manifold 39. Branch conduits or pipes 52 extend from the discharge heads 50 to the conduit 51. The pipe or conduit 51 is provided to deliver or conduct the secondary supply of fire extinguishing medium to the compartment C and extends into the compartment C where it is provided with a suitable discharge nozzle or outlet 54. The outlet 54 may be in the form of a single nozzle or jet and limits the discharge of the secondary supply of fire extinguishing medium causing it to discharge into the compartment slowly. In accordance with the invention, the main supply of fire extinguishing medium under pressure released into the header 39 upon actuation of the heads 14 is conducted to the conduit 51 to actuate the discharge heads 50 and the secondary supply of fire extinguishing medium under pressure thus released from the containers 12 is prevented from passing into the manifold 39, and is caused to discharge into the compartment C through the conduit 51. A suitable check valve D is provided to admit a portion of the main supply of fire extinguishing medium under pressure from the header 39 to the conduit 51 and to prevent the flow of the secondary supply of fire extinguishing medium in the reverse direction.

The check valve D illustrated in the drawing is in the nature of a ball check valve and includes a suitable body 55, having a partition 56. A ball 57 is arranged within the body 55 to close a port 58 in the partition 56. The invention is not to be taken as limited to the particular type of check valve illustrated as any suitable form of check valve may be employed. In accordance with the invention, the conduit 51 may be of a comparatively limited capacity so that a comparatively high pressure or back pressure develops in the conduit 51 when the fire extinguishing medium is discharged into it from the containers 12. The check valve D operates to prevent the fire extinguishing medium under pressure in the conduit 51 from passing into the manifold 39 so that it is caused to pass through the conduit 51 to slowly discharge into the compartment C. The nozzle or jet 54, in being of limited capacity, operates to retard or lessen the rate of discharge of the secondary supply of the fire extinguishing medium into the compartment C. It is to be understood that the capacity of the jet 54 may be definitely related to the quantity and pressure of the secondary supply of fire extinguishing medium to provide for its discharge into the compartment at any desired rate. A suitable reducer 59 is shown arranged between the check valve D and the manifold 39.

It is believed that the operation of the fire extinguishing system provided by the present invention will be readily understood from the foregoing detailed description. Any one of the discharge heads 14 may be manually actuated by depressing its knob or cap 35, or the electrically actuated device 43 may be set off by manual closing of the switch A, or automatic closing of the switch B to create a fluid pressure in the cylinder opening 29 of the discharge head to actuate the same. Upon actuation of any of the discharge heads 14, the various other discharge heads 14 are actuated to release the fire extinguishing medium under pressure from the containers 10 so that the main or principal supply of the fire extinguishing medium is all released into the header 39. Some of the fire extinguishing medium under pressure in the header 39 passes through the check valve D into the conduit 51. The conduit 51 being of less capacity than the header 39, provides or insures the actuation of the discharge heads 50 through the action of the fluid pressure delivered through the conduits 52. Upon the actuation of the discharge heads 50 and the resultant releasing of the secondary supply of fire extinguishing medium from the containers 12, a comparatively high fluid pressure develops in the limited conduit 51 to cause closing of the check valve D. In this manner, substantially the entire main or principal supply of fire extinguishing medium is caused to discharge through the pipe 40 into the compartment C, while the secondary supply of fire extinguishing medium from the containers 12 is caused to discharge slowly from the restricted outlet 54 of the conduit 51. In practice, the discharge jet 54 may be of such capacity as to provide for the discharge of the secondary supply of fire extinguishing medium into the compartment C at any desired rate, and in any desired volume. It is preferred to have the secondary supply of fire extinguishing medium discharge into the compartment C for a substantial period after the releasing of the principal supply of the extinguishing medium and in sufficient volume

to maintain an effective fire extinguishing atmosphere in the compartment C.

The principal or main supply of fire extinguishing medium released from the containers 10 in the compartment C is preferably sufficient to effectively extinguish any fire that may occur in the compartment while the secondary supply of fire extinguishing medium released from the containers 12 is sufficient to maintain an effective fire extinguishing atmosphere in the compartment for a considerable period and compensate for any leakage of fire extinguishing medium from the compartment so that the restarting or recurrence of the fire is prevented. It is to be noted that the system provided by the present invention is particularly simple and is adapted for use in various situations. The releasing of the secondary supply of fire extinguishing medium held in the containers 12 is entirely automatic and is subsequent to the release of the main or principal supply of the extinguishing medium. While the initiation of discharge of the secondary supply is subsequent to that of the principal supply, nevertheless the intervening time interval is so slight that the initiating of the discharge from the two supplies may be regarded as substantially simultaneous. The system does not require special regulating valves, or the like, and involves the minimum amount of piping, etc.

It is to be noted that in actual practice the rapid discharge of a container of carbon dioxide liquefied under pressure results in the formation of a certain amount of carbon dioxide snow within the container. This snow will sublime slowly so that after the container has for all practicable purposes completely discharged, a gas from the snow will continue to fume very slowly, and for a long period, out of the container. In the accompanying claims, the qualifying terms "substantially entirely discharged", "substantially entirely released", "substantially ceased" etc. are intended to mean the discharge from the normal liquid and gaseous content of the container as distinguished from the slow discharge due to sublimation of snow. In other words, the term "substantially" is inserted to recognize the fact that there may be a further discharge due to the presence of snow in the container.

Having described only typical preferred forms 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:

Having described our invention, we claim:

1. A fire extinguishing system including, means holding a main supply of fire extinguishing medium under pressure, means for releasing the main supply of fire extinguishing medium to discharge into a compartment from which gas may have limited egress, means holding a secondary supply of fire extinguishing medium under pressure, means actuated by the released main supply of fire extinguishing medium for releasing the secondary supply, and means discharging the released secondary supply of fire extinguishing medium into the compartment, the last named means being related to the supplies of fire extinguishing medium and to the means for discharging the main supply into the compartment to cause the secondary supply to continue to be discharged into the compartment for a substantial period after the main supply has been substantially entirely discharged into the compartment.

2. In combination, a compartment to be protected and from which gas may have limited egress, two containers holding a fire extinguishing gas under pressure, means for releasing the gas from one container to discharge into the compartment to create a fire extinguishing atmosphere therein, means actuated by gas under pressure thus released to automatically release the gas from the other container, and means retarding the rate of discharge of the gas from the said other container into the compartment with respect to the rate of discharge therein from the first container to cause the gas from said other container to continue to discharge into the compartment after the gas from the first container has substantially entirely discharged into the compartment to maintain a fire extinguishing atmosphere in the compartment for a substantial period.

3. In combination, a compartment to be protected and from which gas may have limited egress, two containers holding a fire extinguishing gas under pressure, means for releasing the gas from one container to discharge into the compartment to create a fire extinguishing atmosphere therein, means automatically actuated by the gas released from said container for releasing the gas from the other container, and means retarding the discharge of the gas from the said other container into the compartment to maintain a fire extinguishing atmosphere therein for a substantial period, the last named means including a conduit for passing the gas from the said other container to the compartment, and a discharge jet on the conduit related in capacity to the volume and pressure of the gas in the first released container, to the capacity of the first mentioned means and to the volume of the gas in the said other container and the pressure under which it is held to cause the gas from the said other container to continue to discharge into the compartment for a considerable period after the gas from the first container has been substantially entirely released into the compartment.

4. In combination, a compartment to be protected and from which gas may have limited egress, two containers holding a fire extinguishing gas under pressure and each having a discharge device, a conduit extending from the discharge device of one container to the compartment, means for actuating the discharge device on the said container to establish a fire extinguishing atmosphere in said compartment, means for utilizing the pressure of the gas released from said container to immediately actuate the discharge device of the other container, and means discharging the gas thus released from the said other container into the compartment related to the volume and pressure of the gas in the first container and its rate of discharge into the compartment so that the gas from the said other container continues to discharge into the compartment after the gas from the first container has substantially entirely discharged into the compartment to maintain the fire extinguishing atmosphere for a substantial period.

5. In combination, a compartment to be protected from which gas may have limited egress, two containers holding a fire extinguishing gas under pressure and each having a discharge device, a conduit extending from the discharge device of one container and having an outlet opening into the compartment, means for actuating the

discharge device on said container to establish a fire extinguishing atmosphere in said compartment, and means for utilizing the pressure of the gas released from said container to actuate the discharge device of the other container and for discharging the gas thus released from said other container into the compartment to maintain the fire extinguishing atmosphere therein for a substantial period, said means including a conduit communicating with the first mentioned conduit and extending from the discharge device of the said other conduit to the compartment, a check valve in the latter conduit allowing flow from the first mentioned conduit and preventing flow in the reverse direction, and an outlet on the said latter conduit related to the volume and pressure of the gas in the first container and its rate of discharge into the compartment so that the gas from the said other container continues to discharge into the compartment after the gas from the first container has substantially entirely discharged into the compartment.

6. In combination, a compartment to be protected from which gas may have limited egress, two containers holding a fire extinguishing gas under pressure and each having a discharge device, a conduit extending from the discharge device of one container to the compartment, remote control means for actuating the discharge device on said container to establish a fire extinguishing atmosphere in said compartment, means utilizing the pressure of the gas released from said container to actuate the discharge device of the other container and means for discharging the gas thus released from the said other container into the compartment at a rate adapted to continue the flow of gas into the compartment for a considerable period after the gas from the first container has substantially entirely discharged into the compartment to maintain the fire extinguishing atmosphere in the compartment for a substantial period.

7. In combination, a compartment to be protected from which gas may have limited egress, two containers holding a fire extinguishing gas under pressure and each having a discharge device, a conduit extending from the discharge device of one container to the compartment, temperature responsive means for actuating the discharge device on said container to establish a fire extinguishing atmosphere in the said compartment, means utilizing the pressure of the gas released from said container to actuate the discharge device of the other container, and means for discharging the gas thus released from the said other container into the compartment at a rate adapted to continue the flow of gas into the compartment for a considerable period after the gas from the first container has substantially entirely discharged into the compartment to maintain the fire extinguishing atmosphere in the compartment for a substantial period.

8. In combination, an enclosure to be protected and from which gas may have limited egress, two containers holding fire extinguishing gas under pressure, a fluid pressure actuated discharge device for one container, means for releasing the gas from said other container, a conduit for delivering the gas thus released to the enclosure to create a fire extinguishing atmosphere therein, and means for actuating the discharge device and for slowly discharging the gas thus released into the enclosure to maintain the fire extinguishing atmosphere therein, including a pipe in communication with said conduit and connected with the discharge device and having a portion for discharging the gas from the said device into the enclosure, a check valve connecting the pipe and conduit and allowing the flow of gas from the conduit to said device and preventing the flow in the opposite direction and a discharge nozzle on said pipe adapted to reduce the rate of discharge from the pipe into the enclosure to such an extent that the gas from the first container continues to discharge into the enclosure for a considerable period after the gas from the said other container has been substantially entirely discharged into the compartment.

9. In a fire extinguishing system for protecting an enclosure from which gas may have limited egress, two containers holding fire extinguishing fluid under pressure, means for discharging fluid from one of the containers into the enclosure, means actuated by the pressure of the fluid from the last named container for effecting discharge of the other container into the enclosure, and means controlling the rate of discharge of one of the containers into the enclosure to cause its fluid to continue to flow into the enclosure for a substantial period after the other container has substantially entirely discharged into the enclosure.

10. In a fire extinguishing system for protecting an enclosure from which gas may have limited egress, two containers holding fire extinguishing fluid under pressure, means remotely controlled for discharging fluid from one of the containers into the enclosure, means actuated by the pressure of the fluid from the last named container for effecting discharge of the other container into the enclosure, and means for retarding the rate of discharge from one of the containers into the enclosure to cause its fluid to continue to flow into the enclosure for a substantial period of time after the fluid from the other container has substantially entirely discharged into the enclosure.

11. In a fire extinguishing system for protecting an enclosure from which gas may have limited egress, two containers holding fire extinguishing gas under pressure, means for discharging gas from both of the containers substantially simultaneously into the enclosure to establish a fire extinguishing atmosphere therein, and means for retarding the rate of discharge from one of the containers, the relative volumes of the containers and their relative rates of discharge being so proportioned that gas from the container whose discharge is retarded will continue to flow into the enclosure for a substantial period after the discharge from the other container has substantially ceased so as to compensate for said egress and maintain the fire extinguishing atmosphere in the enclosure during said period.

12. The method of extinguishing and preventing reignition of a fire in a compartment from which gas may have limited egress which consists in discharging into the compartment fire extinguishing gas from two limited sources of supply, proportioning the relative capacities and rates of discharge from said sources so that the discharge from one will quickly create a fire extinguishing atmosphere and the discharge from the other will continue in quantity sufficient to compensate for said egress for a considerable period after the discharge from the first has substantially ceased.

13. In a fire extinguishing system for protecting an enclosure from which gas may have limited egress, a primary container and a secondary

container, each holding fire extinguishing fluid under pressure, means for releasing fluid from the primary container, a primary conduit arranged to convey and discharge the released fluid into the enclosure to establish a fire extinguishing atmosphere therein, means responsive to the release of fluid from the primary container for releasing fluid from the secondary container, and a secondary conduit arranged to convey and discharge the released fluid from the secondary conduit into the enclosure, the capacities of the two containers and the rates of discharge of the conduits being so relatively proportioned that fluid from the second conduit will continue to flow into the enclosure in quantity sufficient to maintain said fire extinguishing atmosphere for a considerable period after the flow from the primary container has substantially ceased.

14. In a fire extinguishing system for protecting an enclosure from which gas may have limited egress, a primary container and a secondary container, each holding fire extinguishing fluid under pressure, means for releasing fluid from the primary container, a primary conduit arranged to convey and discharge the released fluid into the enclosure to establish a fire extinguishing atmosphere therein, means responsive to the release of fluid from the primary container for releasing fluid from the secondary container, and a secondary conduit arranged to convey and discharge the released fluid from the secondary conduit into the enclosure, the secondary conduit having a discharge nozzle constructed and arranged to restrict the discharge of fluid therefrom with respect to the discharge from the primary conduit, the relative capacities of the two containers and the relative rates of discharge from the two conduits being so proportioned that the fluid from the secondary conduit will continue to flow into the enclosure in quantity sufficient to maintain the fire extinguishing atmosphere for a considerable period after the flow from the primary container has substantially ceased.

15. In a fire extinguishing system for protecting an enclosure from which gas may have limited egress, a primary container and a secondary container, each holding fire extinguishing fluid under pressure, means for releasing fluid from the primary container, a primary conduit arranged to convey and discharge the released fluid into the enclosure to establish a fire extinguishing atmosphere therein, means responsive to the release of fluid from the primary container for releasing fluid from the secondary container, and a secondary conduit arranged to convey and discharge the released fluid from the secondary conduit into the enclosure, the primary conduit having a plurality of discharge nozzles arranged to distribute the discharge therefrom over a wide area and the secondary conduit having a single discharge nozzle arranged to restrict the discharge therefrom, the relative capacities of the two containers and the relative rates of discharge from the two conduits being so proportioned that fluid from the secondary conduit will continue to flow into the enclosure in quantity sufficient to maintain the fire extinguishing atmosphere over a considerable period after the flow from the primary container has substantially ceased.

16. The method of extinguishing and preventing reignition of a fire in a compartment from which gas may have limited egress, which consists in discharging into the compartment fire extinguishing gas from two limited sources of supply, proportioning said sources and regulating the relative rates of discharge therefrom so that the gas from one of the sources will quickly create a fire extinguishing atmosphere in the compartment and the discharge from the other source will continue for a substantial period after that from the first source has substantially ceased, to compensate for said egress and maintain a fire extinguishing atmosphere in the compartment for a substantial period.

OZRO N. WISWELL.
SCOTT E. ALLEN.