April 13, 1937. S. E. ALLEN 2,076,692

FIRE EXTINGUISHING APPARATUS

Filed Sept. 8, 1934

Fig. 1.

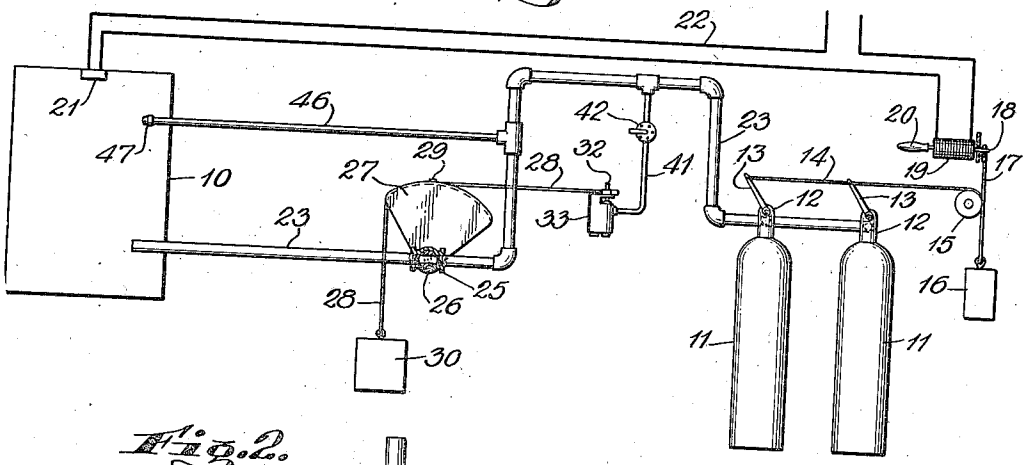


Fig. 2.

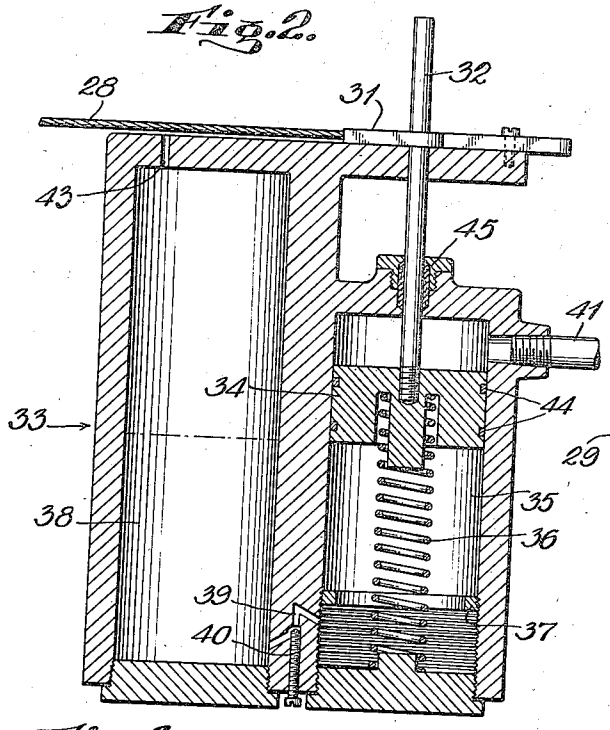


Fig. 4.

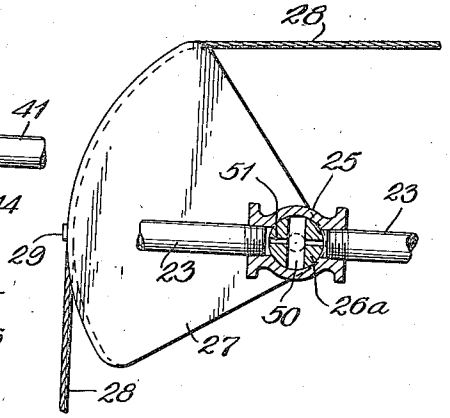
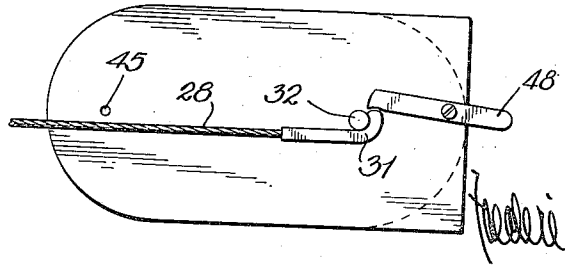


Fig. 3.



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FIRE EXTINGUISHING APPARATUS

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Application September 8, 1934, Serial No. 743,233

13 Claims. (Cl. 169—11)

The present invention relates to fire extinguishing systems employing highly compressed gas, such, for instance, as carbon dioxide, in which an initial discharge of large volume is followed by an auxiliary discharge. Such systems are particularly useful in protecting enclosures from which gas has limited egress. The initial charge is adapted to establish quickly a fire extinguishing atmosphere in the enclosure so as to put out fire therein, and thereafter, by feeding extinguishing gas into the enclosure at a rate sufficient to compensate for such egress, said extinguishing atmosphere is maintained for a period long enough to prevent reignition. Unless an extinguishing atmosphere is maintained reignition might occur if the enclosure contains certain machinery, such as an electric generator, which cannot be stopped abruptly and may continue to rotate for a long period under its own momentum and which might fan the fire into life again.

Such a fire extinguishing system as described above is disclosed in Patent No. 1,969,869, issued August 14, 1934. In the specific embodiment described in said patent there are successive discharges of extinguishing fluid at time controlled intervals. In a copending application Serial No. 610,066, filed May 9, 1932, is disclosed another system in which there is a substantially simultaneous discharge into the enclosure from two sources, the relative volumes of the sources and their relative rates of discharge being so proportioned that gas from one source will quickly create a fire extinguishing atmosphere in the enclosure and fluid will continue to flow from the other source in sufficient quantity to maintain said atmosphere for a substantial period after the flow from the first source has substantially ceased.

An object of the present invention is to provide a still different method of and means for protecting an enclosure from which gas has limited egress.

A more specific object of the invention is to provide a very simple system in which a single source of supply may be employed not only for the initial discharge to establish a fire extinguishing atmosphere but also to supply the enclosure with gas at a reduced rate over a long period so as to compensate for such egress.

Other objects and advantages of my invention will appear in the following description of a preferred embodiment and thereafter the novelty and scope of the invention will be pointed out in the claims.

In the accompanying drawing:

Figure 1 is a somewhat diagrammatic view in side elevation of a fire extinguishing system embodying my invention;

Fig. 2 is a view in vertical section of a timing device employed in said system;

Fig. 3 is a plan view of the timing device; and

Fig. 4 is a detail view in longitudinal section of a modified form of control valve.

An enclosure 10 is indicated in Figure 1 from which gas has limited egress. To protect this enclosure a supply of highly compressed fire extinguishing fluid is provided. In the drawing, this supply is indicated as consisting of a pair of cylinders 11 containing carbon dioxide liquefied under pressure.

Each cylinder is provided with a discharge head 12 which may be of a standard construction, with means for releasing the fluid from the cylinders either automatically or manually. In Figure 1, this means is shown as consisting of a discharge lever 13 projecting from each discharge head 12, said levers being connected to a common rope 14 which passes over a pulley 15 and has a weight 16 attached to its extremity. Normally the rope is relieved of the load of weight 16 by a line 17 attached to the weight at one end and hooked at its opposite end over a pin 18. This pin forms an extension of the core of a solenoid 19 so that when the solenoid is actuated it will withdraw the pin 18 permitting the weight to drop and thereby swinging the lever 13 to operate the discharge heads 12 and permit release of fluid from the cylinders 11. A handle 20 connected to the pin or core 18 may be manually operated to release the weight 16 whenever desired.

To effect automatic release of the weight when the temperature in the enclosure 10 rises to a dangerous point, I provide a thermostatic switch 21 in the enclosure 10 which normally interrupts the energizing circuit 22 of the solenoid 19 but which will complete this circuit when predetermined dangerous temperature conditions occur in the enclosure. Obviously, any kind of a thermostatic control may be employed to effect energization of the solenoid 19.

When the discharge heads 12 are operated fluid from the containers 11 will discharge into a conduit 23 leading therefrom to the enclosure 10. This conduit is normally open so that the fluid will discharge directly into the enclosure 10. However, a valve 25 is provided in the conduit at a suitable point and preferably near the enclosure 10. This valve is of the rotary plug type, comprising a plug 26 to which is fixed a sector 27.

An actuating rope 28 passes about the sector and is attached to the periphery thereof at 29. One end of this rope is connected to a weight 30 while the opposite end is provided with a hook 31 which engages a stem 32 projecting from a timing device 33.

The interior of the timing device is shown in Fig. 2. The stem 32 is fixed at its lower end to a piston 34 which has a close sliding fit in a cylinder 35. A spring 36 normally holds this piston in raised position. A ring 37 is threaded into the lower end of the cylinder and provides an adjustable stop to limit depression of the piston 34. The timing device also includes an oil reservoir 38 which is connected to the lower end of the cylinder 35 by a passage 39. A needle valve 40 is provided to close this passage to any degree desired.

A branch line 41 leads from the conduit 23 to the top of the cylinder 35 so that when the fluid is admitted into the conduit it will depress the piston 34. In the line 41 there is a pressure regulator 42. A quantity of oil is maintained in the timing device and this resists depression of the piston 34 to an extent controlled by the adjustment of the needle valve 40, for as the piston 34 is lowered it will displace oil from the cylinder 35, forcing the displaced oil through passage 39 and past the needle valve into the reservoir 38. A vent 43 is provided to release air that may be trapped in the reservoir. It will be understood that the piston 34 makes a very close fit with the cylinder 35, being provided with piston rings 44, and the stem 32 is provided with a stuffing box 45 so as to prevent escape of fluid under pressure introduced through the pipe 41.

A branch line 46 extends from the conduit 23 on the upstream side of the valve 25 into the enclosure 10. This branch line may either be of such reduced diameter as to feed a very small stream of fluid into the enclosure 10 or it may be provided with a nozzle 47 adapted to reduce the jet of discharging fluid to the desired proportions. It will be understood that the supply of fluid coming through the line 46 may be adjusted by the selection of a nozzle 47 of proper size to compensate for gas that may escape from the conduit 10.

In operation when there is a fire in the enclosure 10 the fluid from containers 11 is either automatically or manually released into the conduit 23. This fluid will flow freely through the open valve 25 into the enclosure, although a part of it will pass through the line 46 into the enclosure. A fire extinguishing atmosphere will thus be created very quickly in the enclosure 10. In the meantime, part of the fluid under pressure of the regulator 42 will enter the top of cylinder 45, forcing the piston 34 downward at a rate controlled by the setting of needle valve 40. When the piston reaches the bottom of its stroke the stem 32 will be withdrawn from the hook 31, releasing the rope 28 and permitting the weight 30 to close the valve 25. In this way, the main discharge will be terminated and thereafter the discharge will be continued through line 46 at a rate sufficient to compensate for losses of gas from the enclosure 10 so as to maintain the fire extinguishing atmosphere therein.

If for any reason the timing device should fail to operate satisfactorily the hook 31 may be manually released from the stem 32 by operating lever 48 to push the hook clear of the stem.

If desired, the auxiliary line 46 and 47 may be dispensed with and the flow of fluid at reduced rate into the enclosure 10 may be controlled by the control valve 25. In such case, the valve is provided with a plug 26a, Fig. 4, having a main discharge duct 50 therethrough for the normal passage of fluid and an auxiliary duct 51 disposed at right angles to the passage 50. The duct 51 is of greatly reduced diameter so that only a small flow of fluid will pass therethrough.

Fig. 4 shows the position of the plug 26a after the timing mechanism has been operated to release the weight 30 and swing the plug through an angle of 90 degrees. In this position, which occurs after the fire extinguishing atmosphere has been established in the enclosure 10, the only passage for the fluid is through the duct 51 and consequently the flow is abruptly reduced by the turning of the valve to an amount which at least will compensate for the limited egress from the enclosure.

While I have described a preferred embodiment of my invention and a modification thereof, it will be understood that these are to be taken as illustrative and not limitative of my invention and that I reserve the right to make various changes in form, construction, and arrangement of parts without departing from the spirit and scope of my invention as pointed out in the following claims.

I claim:

1. A fire extinguishing apparatus for protecting an enclosure from which gas may have limited egress, said apparatus comprising, in combination, a conduit leading into the enclosure, means for supplying the conduit with fire extinguishing fluid which is gaseous at normal atmospheric pressures and temperatures from a supply of the fluid which is considerably in excess of that necessary to establish a fire extinguishing atmosphere in the enclosure, the conduit being constructed and arranged to discharge the fluid at a rate sufficient to establish quickly said fire extinguishing atmosphere, a normally open valve controlling discharge of the conduit, means normally restraining the flow to said normally open valve but operable to permit such flow when a fire occurs, means for closing the valve after said fire extinguishing atmosphere has been established, and means for continuing the discharge of said fluid into the enclosure thereafter at a materially reduced rate sufficient however to compensate for said egress.

2. A fire extinguishing apparatus for protecting an enclosure from which gas may have limited egress, said apparatus comprising, in combination, a conduit leading into the enclosure, means for supplying the conduit with fire extinguishing fluid which is gaseous at normal atmospheric pressures and temperatures from a supply of the fluid which is in excess of that necessary to establish a fire extinguishing atmosphere in the enclosure, the conduit being constructed and arranged to discharge the fluid at a rate sufficient to establish quickly said fire extinguishing atmosphere, a normally open valve in the conduit controlling discharge thereof, means normally restraining the flow to said normally open valve but operable to permit such flow when a fire occurs, time delay means for closing the valve at a predetermined time interval after admission of fluid into the enclosure sufficient to establish said fire extinguishing atmosphere, and means for supplying the enclosure with fire extinguishing fluid for a prolonged period after operation of the timing device at a materially reduced rate sufficient however to compensate for said egress.

3. A fire extinguishing apparatus for protecting an enclosure from which gas may have limited egress, said apparatus comprising, in combination, a conduit leading into the enclosure, means for supplying the conduit with compressed fire extinguishing fluid which is gaseous at normal atmospheric pressures and temperatures from a supply of the fluid which is in excess of that necessary to establish a fire extinguishing atmosphere in the enclosure, the conduit being constructed and arranged to discharge the fluid at a rate sufficient to establish quickly said fire extinguishing atmosphere, a normally open valve controlling the discharge of the conduit, means normally restraining the flow to said normally open valve but operable to permit such flow when a fire occurs, time delay means controlled by pressure of the fluid for closing the valve at a predetermined time after initial discharge of the fluid sufficient to establish said fire extinguishing atmosphere in the enclosure, and means for supplying the enclosure with extinguishing gas for a prolonged period after operation of the timing device at a materially reduced rate sufficient however to compensate for said egress.

4. A fire extinguishing apparatus for protecting an enclosure from which gas may have limited egress, said apparatus comprising, in combination, a conduit leading into the enclosure, means for supplying the conduit with compressed fire extinguishing fluid which is gaseous at normal atmospheric pressures and temperatures from a supply of the fluid which is in excess of that necessary to establish a fire extinguishing atmosphere in the enclosure, the conduit being constructed and arranged to discharge the fluid at a rate sufficient to establish quickly said fire extinguishing atmosphere, a normally open valve controlling the discharge of the conduit, means normally restraining the flow to said normally open valve but operable to permit such flow when a fire occurs, time delay means controlled by pressure of the fluid for closing the valve at a predetermined time after initial discharge of the fluid sufficient to establish said fire extinguishing atmosphere in the enclosure, means for supplying the enclosure with extinguishing gas for a prolonged period after operation of the timing device at a materially reduced rate sufficient however to compensate for said agress, and means for adjusting the timing of the time delay means.

5. A fire extinguishing apparatus for protecting an enclosure from which gas may have limited egress, said apparatus comprising, in combination, a conduit leading into the enclosure, means for supplying the conduit with compressed fire extinguishing fluid which is gaseous at normal atmospheric pressures and temperatures from a supply of the fluid which is in excess of that necessary to establish a fire extinguishing atmosphere in the enclosure, the conduit being constructed and arranged to discharge the fluid at a rate sufficient to establish quickly said fire extinguishing atmosphere, a normally open valve controlling the discharge of the conduit, means normally restraining the flow to said normally open valve but operable to permit such flow when a fire occurs, time delay means controlled by pressure of the fluid for closing the valve at a predetermined time after initial discharge of the fluid sufficient to establish said fire extinguishing atmosphere in the enclosure, means for supplying the enclosure with extinguishing gas for a prolonged period after operation of the timing device at a materially reduced rate sufficient however to compensate for said egress, and means for controlling the pressure supplied to the time delay means.

6. A fire extinguishing apparatus for protecting an enclosure from which gas may have limited egress, said apparatus comprising, in combination, a conduit leading into the enclosure, means for supplying the conduit with fire extinguishing fluid which is gaseous at normal atmospheric pressures and temperatures, the conduit being constructed and arranged to discharge the fluid at a rate sufficient to establish quickly a fire extinguishing atmosphere in the enclosure, a valve in the conduit controlling discharge thereof, means normally restraining the flow to said normally open valve but operable to permit such flow when a fire occurs, said valve having a large port for the normal passage of fluid therethrough and a small port, and means for operating the valve to cut off the large port and open the small port to the passage of the fluid after a fire extinguishing atmosphere has been established in the enclosure so that the fluid will continue to flow into the enclosure at a materially reduced rate sufficient however to compensate for said egress.

7. A fire extinguishing apparatus for protecting an enclosure from which gas may have limited egress, said apparatus comprising, in combination, a conduit leading into the enclosure, means for supplying the conduit with compressed fire extinguishing fluid which is gaseous at normal atmospheric pressures and temperatures from a supply of the fluid which is considerably in excess of that necessary to establish a fire extinguishing atmosphere in the enclosure, the conduit being constructed and arranged to discharge the fluid at a rate sufficient to establish quickly said fire extinguishing atmosphere, a valve in the conduit controlling discharge thereof, means normally restraining the flow to said normally open valve but operable to permit such flow when a fire occurs, said valve having a large port for the normal passage of fluid therethrough and a small port, and time delay means controlled by the pressure of said fluid for operating the valve to close the large port and open the smaller port for passage of fluid therethrough after said fire extinguishing atmosphere has been established so that the fluid will continue to discharge into the enclosure at a materially reduced rate sufficient however to compensate for said egress.

8. A fire extinguishing apparatus for protecting an enclosure from which gas may have limited egress, said apparatus comprising, in combination, a supply of highly compressed fire extinguishing fluid which is gaseous at normal atmospheric pressures and temperatures, said supply being sufficient to establish a fire extinguishing atmosphere in the enclosure and maintain said atmosphere for a prolonged period, a pair of conduits leading into the enclosure, means for releasing said fluid into the conduits, one of the conduits being constructed and arranged to discharge a large stream of the fluid into the enclosure so as to establish quickly a fire extinguishing atmosphere therein, the other conduit being constructed and arranged to discharge the fluid into the conduit at a reduced rate sufficient however to compensate for said egress, a normally open valve controlling the discharge of the larger stream, and means for closing said valve after

said fire extinguishing atmosphere has been established.

9. A fire extinguishing apparatus for protecting an enclosure from which gas may have limited egress, said apparatus comprising, in combination, a supply of highly compressed fire extinguishing fluid which is gaseous at normal atmospheric pressures and temperatures, said supply being sufficient to establish and maintain a fire extinguishing atmosphere in the enclosure for a prolonged period, a pair of conduits leading into the enclosure, means for releasing said fluid into the conduits, one of the conduits being constructed and arranged to discharge a large stream of the fluid into the enclosure so as to establish quickly a fire extinguishing atmosphere therein, the other conduit being constructed and arranged to discharge the fluid into the conduit at a reduced rate sufficient however to compensate for said egress, a normally open valve controlling the discharge of the larger stream, and means controlled by pressure of the fluid for closing said valve after said fire extinguishing atmosphere has been established.

10. A fire extinguishing apparatus for protecting an enclosure from which gas may have limited egress, said apparatus comprising, in combination, a supply of highly compressed fire extinguishing fluid which is gaseous at normal atmospheric pressures and temperatures, said supply being sufficient to establish and maintain a fire extinguishing atmosphere in the enclosure for a prolonged period, a conduit system leading into the enclosure, means for releasing said fluid into the conduit system, the latter being constructed and arranged to discharge fluid rapidly into the enclosure so as to establish quickly a fire extinguishing atmosphere therein, a normally open valve in the conduit system, and time delay means controlled by pressure of the fluid in the conduit system for operating the valve after said fire extinguishing atmosphere has been established in the enclosure to reduce the discharge materially but not below a rate sufficient to compensate for said egress.

11. A fire extinguishing apparatus for protecting an enclosure from which gas may have limited egress, said apparatus comprising, in combination, a supply of highly compressed fire extinguishing fluid which is gaseous at normal atmospheric pressures and temperatures, said supply being sufficient to establish and maintain a fire extinguishing atmosphere in the enclosure for a prolonged period, a conduit system leading into the enclosure, means controlled by temperature conditions in the enclosure for releasing said fluid into the conduit system, the latter being constructed and arranged to discharge fluid rapidly into the enclosure so as to establish quickly a fire extinguishing atmosphere therein, a normally open valve in the conduit system, and time delay means controlled by pressure of the fluid in the conduit system for operating the valve after said fire extinguishing atmosphere has been established in the enclosure to reduce the discharge materially but not below a rate sufficient to compensate for said egress.

12. A fire extinguishing apparatus for protecting an enclosure from which gas may have limited egress, said apparatus comprising, in combination, a conduit leading into the enclosure, means operable when a fire occurs to connect the conduit to a source of fire extinguishing fluid which is gaseous at normal atmospheric pressures and temperatures so as to lead said fluid into said enclosure, said source comprising an amount of the fluid considerably in excess of that necessary to establish a fire extinguishing atmosphere in the enclosure, the conduit being constructed and arranged to discharge said fluid at a rate sufficient to establish quickly said fire extinguishing atmosphere in the enclosure, and means for materially reducing the rate of discharge from said source after the fire extinguishing atmosphere has been established, the reduced rate of discharge being sufficient however to compensate for said egress, and time controlled means for operating the rate reducing means.

13. A fire extinguishing apparatus for protecting an enclosure from which gas may have limited egress, said apparatus comprising, in combination, a conduit leading into the enclosure, means operable when a fire occurs to connect the conduit to a source of fire extinguishing fluid which is gaseous at normal atmospheric pressures and temperatures so as to lead said fluid into said enclosure, said source comprising an amount of the fluid considerably in excess of that necessary to establish a fire extinguishing atmosphere in the enclosure, the conduit being constructed and arranged to discharge said fluid at a rate sufficient to establish quickly said fire extinguishing atmosphere in the enclosure, and means constructed and arranged to terminate such rapid discharge after the fire extinguishing atmosphere has been established and to substitute therefor a materially reduced discharge from said source sufficient however to compensate for said egress.

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