Aug. 17, 1937. S. E. ALLEN 2,090,279

FIRE EXTINGUISHING APPARATUS

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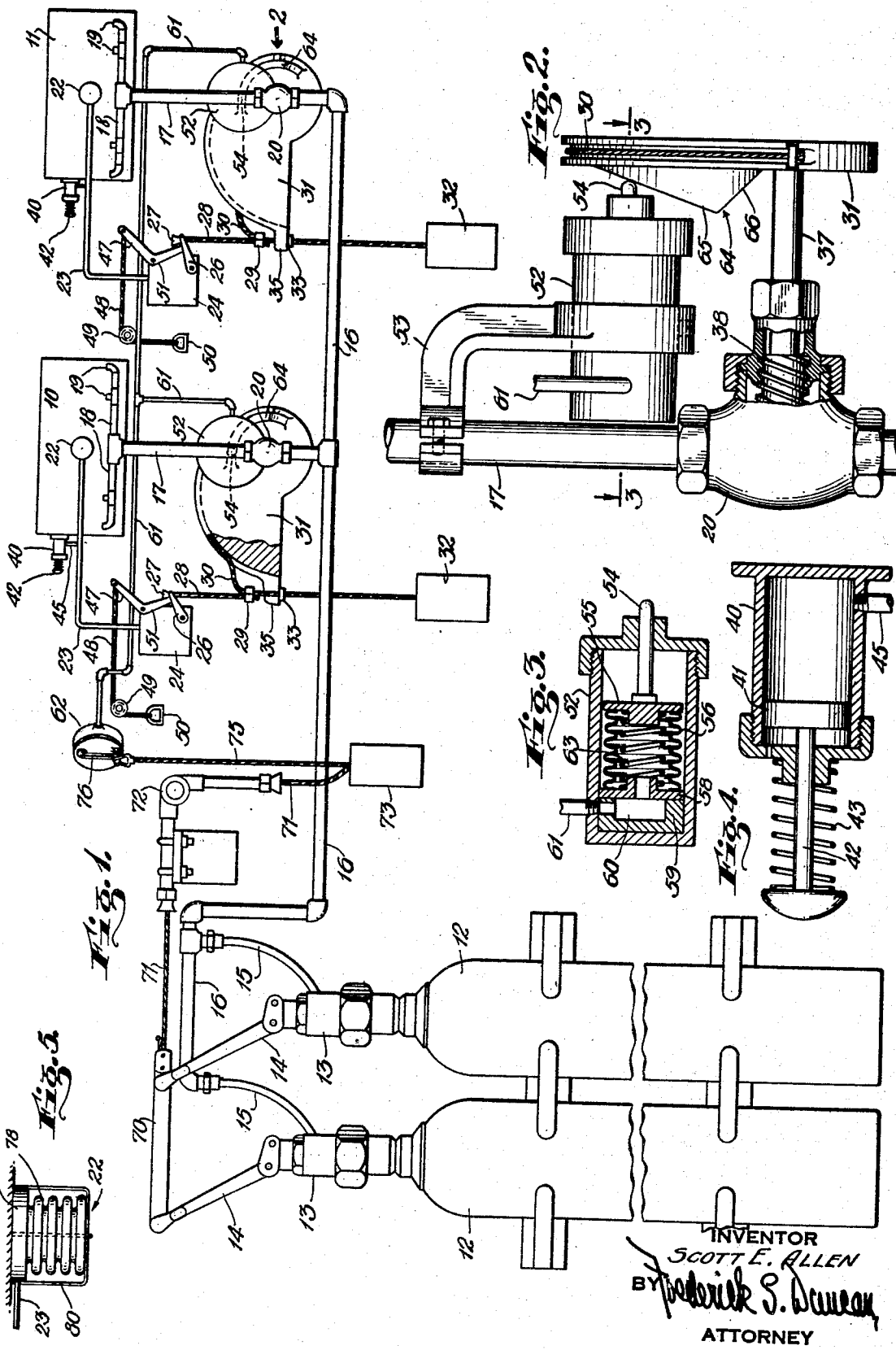


Fig. 1.



Fig. 5.



Fig. 2.



Fig. 3.



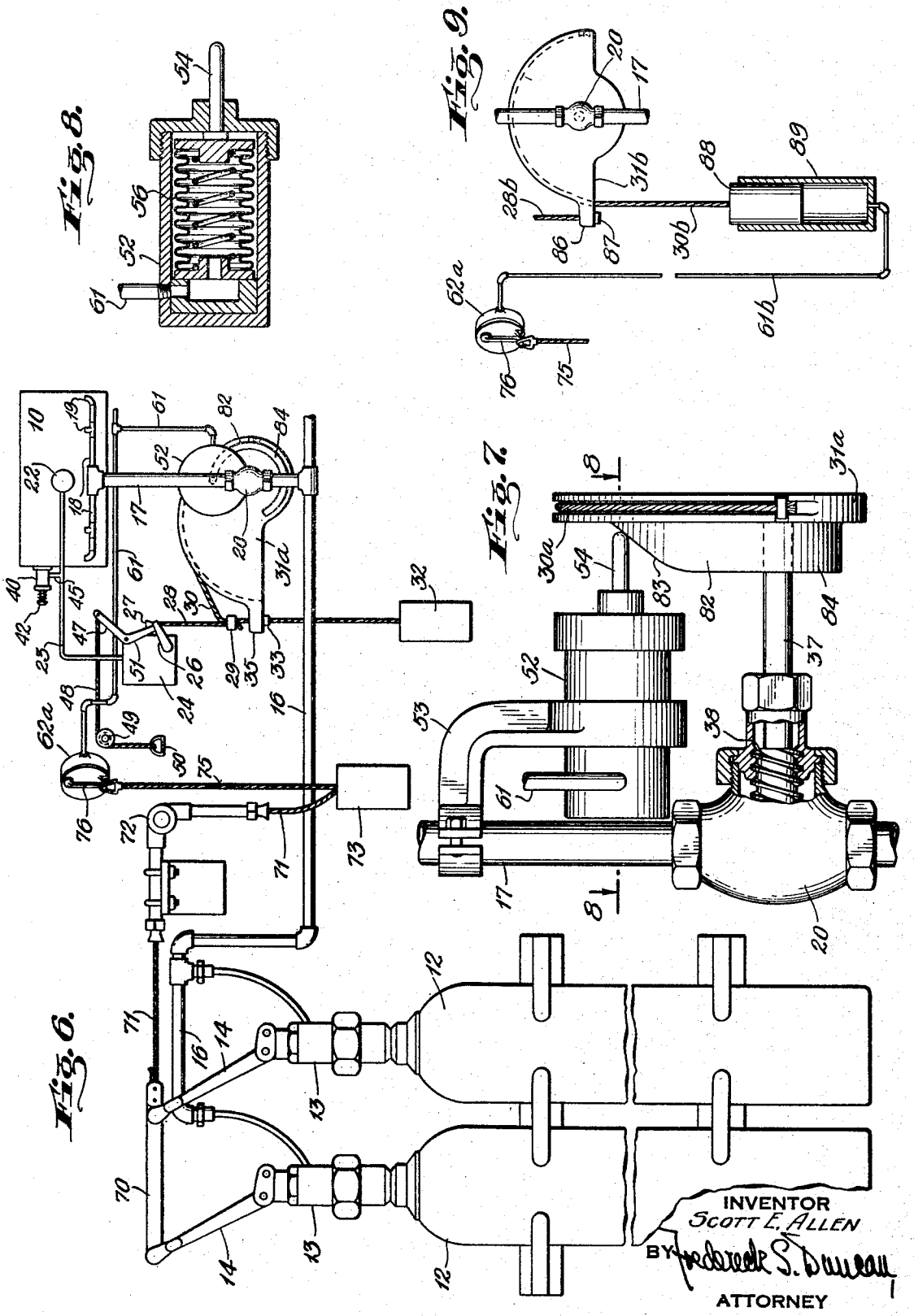
Fig. 4.

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## FIRE EXTINGUISHING APPARATUS

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10 Claims. (Cl. 169—11)

The present invention relates to fire extinguishing apparatus and more particularly to a system in which a common delivery line leads from a source of fire extinguishing fluid to a plurality of fire hazards or zones to be protected, with a main supply valve (or valves) controlling release of the fluid into the delivery line and a selector valve for each of said zones to determine into which of said zones the fluid will be discharged.

An object of the invention is to provide improved means for operating the selector valves and cooperating means between the selector valves and the main valve, whereby whenever any one of the selector valves is opened the main valve will also be opened.

A further object of the invention is to provide a fluid pressure means for transmitting an operative impulse from each selector valve to the main valve or valves.

Another object of the invention is to provide means for generating either a positive or negative fluid pressure impulse when the selector valve is opened and utilizing such impulse to effect the release of fire extinguishing fluid into the delivery line.

In a preferred embodiment of my invention the selector valves and the main supply valve or valves are operated by weights which are released by tripping devices and fluid pressure means are provided for actuating said tripping devices. In each zone or enclosure to be protected is a primary actuator for operating the tripping device for the selector valve controlling delivery to said zone. Obviously, the primary actuator may consist of a thermostatic switch controlling electrical means for releasing the weight, but I prefer to employ a thermosensitive device of the type comprising a fluid chamber in which a fluid is expanded by a rise of temperature, creating pressure sufficient to operate the trip.

An object of my invention is to provide in connection with such a fluid pressure thermostat, auxiliary manual means for producing a rise of pressure so that the selector valve may be opened at will by an attendant.

Another object of my invention is to provide, in each enclosure, a primary actuator which will be responsive not only to a rise of temperature, but also to a sudden rise of atmospheric pressure for operating the tripping device of the selector valve. An advantage of this arrangement is that in case of an explosion the rise of pressure due to such explosion would operate the selector valve immediately and this in turn would operate the main valve, so that the supply of fire extinguishing fluid would reach the enclosure even before there was sufficient rise of temperature to operate the thermostat in the usual way.

With these and other objects in view which will appear hereinafter I shall now describe a preferred embodiment of my invention and certain modifications thereof and thereafter the novelty and scope of the invention will be pointed out in the claims.

In the accompanying drawings:

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

Fig. 2 is a side view on the larger scale and looking in the direction of the arrow 2 in Fig. 1, of one of the selector valves and means associated therewith for generating a minus pressure impulse when the valve is opened;

Fig. 3 is a view in section taken on line 3—3 of Fig. 2;

Fig. 4 is a view in longitudinal section of a manually operable pressure generating means for actuating the tripping device of a selector valve;

Fig. 5 is a view in section of a preferred form of primary actuator which is responsive not only to a rise of temperature but also to a sudden rise of pressure;

Fig. 6 is a view similar to Fig. 1 showing a modified form of my invention;

Fig. 7 is a view in side elevation of one of the selector valves and means associated therewith for generating a positive pressure impulse;

Fig. 8 is a view in section taken on the line 8—8 of Fig. 7; and,

Fig. 9 is a view in front elevation and partly in section of a selector valve with another form of pressure generating means.

In the system illustrated in Fig. 1, I show two rooms or enclosures 10 and 11 respectively which are to be protected against fire. A battery of cylinders 12 containing carbon dioxide liquefied under pressure or other suitable fire extinguishing fluid maintained under pressure, is provided to extinguish a fire in said enclosures. Each of the cylinders 12 is provided with a suitable discharge head 13 adapted to be operated by a lever 14 to release the fluid from the cylinder. The fluid thus released is led through a pipe 15 into a main delivery line 16 leading to the vicinity of the rooms 10 and 11. From the conduit 16 lead branch conduits 17 into the enclosures 10 and 11, each branch line 17 terminating in a spreader 18 provided with discharge nozzles 19. In each of the branch lines 17 there is a valve 20 which, for convenience will be termed a "selector valve". Normally, these

valves are closed and they are opened only in case of a fire in the room to which the branch line leads and such opening is performed either manually or automatically, as will now be explained.

In each room there is a thermo-sensitive device which is in the form of a reservoir or chamber 22 containing air or other suitable expansible fluid and from this chamber leads a pipe 23 to a suitable release device 24. The latter is of well known type comprising a diaphragm which is actuated by a rise of fluid pressure in the chamber 22. Movement of this diaphragm releases an arm 26 which is forked at its outer end and supports a lug 27 at the upper end of a cable 28. This cable 28 at its opposite end is connected by a clamp 29 to a cable 30 which passes about a grooved pulley 31 having a spiral contour. The cable 30, beyond its point of attachment to the cable 28 is connected to a weight 32.

A clamp 33 is secured to the cable 30 at a point spaced below the clamp 29. The pulley 31 is formed with a fork 35 which projects between the clamps 29 and 33 and normally, when the parts are in the position shown in Fig. 1, the pulley 31 is maintained in its raised position by engagement of the lower clamp 33 with the underside of the fork 35. However, when the arm 26 is released it will swing downwardly, letting the lug 27 slip off the fork of said arm, and as the weight 32 drops the clamp 29 will strike the upper side of the fork 35 and cause the pulley 31 to turn on its axis through an angle of substantially 180 degrees.

The pulley 31, as shown in Fig. 2, is fixed to the stem 37 of the valve 20. This valve is of the globe type and the stem 37 has a threaded portion 38 such that when the pulley 31 is turned the valve will be opened. Due to the spiral nature of the pulley there will be a greater turning moment at the beginning of the drop of the weight 32 which will overcome any tendency of the valve to stick. Clamp 29 being spaced above the fork 35 strikes the fork 35 with a hammer blow to insure opening of the valve.

In order to permit of operating the tripping device 24 manually I provide a cylinder 40, Fig. 4, provided with a plunger 41 and a stem 42 projecting from the cylinder 40. A spring 43 normally urges the plunger outwardly, but the plunger may be depressed manually against the action of the spring to generate pressure in the cylinder 40. Pipe 45 connects the cylinder to the pipe 23 so that, whenever desired, pressure may be built up to operate the trip release 24 and thereby drop the weight 32 to open the selector valve 20 associated therewith. Another means of manual control of each selector valve consists in the provision of a bell crank lever 47 pivoted to the casing of the release device 24. One arm of the bell crank lever is connected to a cable 48 which leads to a convenient point of operation where it passes about a pulley 49 and terminates in a hand grip 50. The other arm 51 of the bell crank lever bears against the lug 27, so that by pulling the grip 50 the lug 27 may be pushed off the forked arm 26, thus releasing the weight 32.

There is a suction device associated with each selector valve. This device comprises a cylindrical casing 52 supported by a bracket 53 clamped to the pipe 17 adjacent said valve. Projecting from the casing is a stem 54. The inner end of this stem is connected to a head plate 55 of a collapsible bellows 56. The opposite end of the bellows terminates in a plate 58 which bears against a shoulder formed by an insert 59 in the casing 53. The insert 59 provides a chamber 60 which communicates with the interior of the bellows through a port in the plate 58 and is also connected by a pipe line 61 to a release device 62. The bellows is urged toward expanded condition by an internal spring 63 but is normally prevented from expanding by engagement of the stem 54 with a cam 64 formed on the adjacent face of the pulley. The shape of this cam is such that as the stem 37 is moved outwardly by turning of the pulley 36 there will be initially no outward movement of the stem 54. In other words the cam has an initial inclined surface 65 which is of the same angle as that of the threads 38. A sharp declivity 66 leads from the peak of the incline 65, so that after the stem 54 has passed said peak it may move out suddenly under action of spring 64, thereby producing a suction impulse in the line 61.

The operating levers 14 of the discharge heads 13 ar preferably connected by a strap 70 which in turn is attached to a cable 71 that passes around a pulley 72 and is connected at its lower end to a weight 73. This weight is sufficient to pull the levers 14 and release the fluid from the cylinders 12 into the line 16. In the drawing, we have shown only two cylinders 12, but obviously there can be any desired number of them and the weight 73 will be proportioned to perform the necessary work of opening the discharge heads of the battery of cylinders. The weight 73 is normally held in inactive position, preferably with a certain amount of slack in the line 71, by a cable 75 which at its upper end is connected to a hook lever 76 pivoted on the casing of the release device 62. This release device is of a type well known in the art and needs no description other than to state that it comprises an operating diaphragm which is arranged to release the lever 76 when moved by a suction impulse in the line 61.

The operation of the system will now be understood. In case of a fire in one of the enclosures 10 or 11, the rise of temperature therein will produce pressure in chamber 22 located in said enclosure, thereby operating the tripping device 24 associated therewith to release its arm 26. The weight 32 suspended thereon will then drop and cause the pulley 31 to swing through an angle of about 180 degrees, and in so doing will open the selector valve 20 controlling admission of extinguishing fluid to said enclosure. After the pulley has moved through approximately 90 degrees the stem 54, which has been riding along the cam surface 65 will pass the peak of said surface and be permitted to spring out under pressure of the spring 63. This will cause a sudden expansion of the bellows 56 producing a minus pressure impulse in the line 61 and thereby effecting release of the weight 73, which will cause the cylinders 12 to discharge into the main delivery line 16. The supply of fluid will then flow into the particular enclosure in which the fire is located but will not enter the other enclosure because the selector valve 20 of such other enclosure will remain closed. While I have shown only two rooms or enclosures obviously the system could be extended to incude any number of rooms within practical limits.

While ordinarily the control elements employed for effecting a rise of pressure to operate trip devices like that illustrated at 24, consist of fixed metallic bulbs or reservoirs, I prefer to use a device such as shown in Fig. 5 which will not only respond to a rise of pressure due to thermal conditions but will also respond to marked pressure changes in the surrounding atmosphere. The device comprises a collapsible bellows 70 which is

responsive to predetermined differences of atmospheric pressure. This bellows is provided with a fixed head 79 to which the tube 23 is connected, providing communication with the interior of the bellows. The head 79 may be secured to the ceiling of the enclosure with the bellows 78 depending therefrom. The lower end of the bellows is closed, of course, and a cage 80 of stiff wire or metallic rods encloses the bellows and limits its expansion. This device when subjected to a rise of temperature cannot expand because of the cage 80 and consequently the fluid within the bellows, which may be of the same character as that commonly employed in thermostats of fluid expansion type, must expand and will operate the release device 24. On the other hand should there be an explosion in the chamber the marked rise of atmospheric pressure will cause the bellows 78 to collapse and the pressure in the chamber 10 will thus be transmitted to the release device 24 to operate the same. This novel type of primary actuator is of considerable importance in certain situations. For example, in electrical installations where oil cooled transformers are employed, sometimes there is an explosion of the oil or oil vapors and such explosion will instantly set in motion the mechanism for releasing extinguishing fluid into the chamber without waiting for the more sluggish expansion of fluid due to the rise of temperature. There will thus be an almost instant discharge of extinguishing fluid to smother the fire before it can do any material damage.

The manually operable plunger 41 provides a convenient means of initiating the discharge of extinguishing fluid into the chamber whenever desired, while the cable actuating grip 50 provides another manual means for releasing the weight 32 from a point at a distance from the room to be protected.

In Figs. 6 and 7 I show another form of my invention which is very similar to the structure already described and I employ the same reference numerals to indicate corresponding parts. The principal difference between the two structures lies in the fact that the operation of each selector valve generates pressure instead of suction in the line 61 and this pressure is used to release the weight which operates the discharge heads of the battery of cylinders. To generate such pressure, I employ the same mechanism as shown in Fig. 3, namely, an expansible bellows 56 but normally the bellows is fully expanded, as shown in Fig. 8, and when the adjacent selector valve is operated the bellows is suddenly collapsed to produce the requisite pressure. The difference between the two systems consists therefore mainly in the provision of a pulley 30*a* which differs from the pulley 30 only in having a different form of operating cam 82, while at the other end of the line 61 there is a release device 62*a* which like the device 62 is of standard construction well known in the art but arranged to operate in response to a pressure impulse instead of suction to release the hook lever 76. As shown particularly in Fig. 7 the cam 82 formed on a face of the pulley 31*a* is formed with an initial steep rise 83 which terminates in surface 84 parallel to the face of the pulley 31*a*. The rise 83 is very much steeper than the slope of the threads 38 on the valve stem 37 so that in operation as the pulley 31*a* is turned by the pull of the weight 32 the incline surface 83 of the cam will depress the stem 54 of the bellows despite the fact that the pulley 31*a* is being bodily moved toward the right as viewed in Fig. 7. In other words, the extent of depression of stem 54 is determined by the difference in slope of surface 83 with respect to that of threads 38. The sudden compression of the bellows 56 will transmit a pressure impulse in the line 61 which will operate the device 62*a* to release the hook lever 76, permitting weight 73 to drop and cause the cylinders 12 to discharge into the main delivery line 16 and thence through the particular valve 20 which has been opened into the enclosure controlled by said valve. After the stem 54 has ridden up the incline 83 and has reached the level 84 it may again move outwardly due to the fact that the pulley 30*a* is bodily shifted toward the right by the screwing motion of the stem 37 but such movement of the stem 54 and consequent expansion of the bellows 56 will have no effect because the hook lever 76 will already have released the weight 73.

In Fig. 9, I show still another form of my invention in which parts corresponding to those already described are given like reference numerals. In this structure a pressure impulse is employed to operate a release device 62*a* but the pressure is obtained by the drop of a plunger in a cylinder, such plunger constituting the weight which opens the selector valve. Instead of a spiral pulley 31 or 31*a* I provide a semi-circular pulley 31*b*, having a fork 86 at one end through which passes a cable 28*b* provided at its lower end with a stop 87. This cable 28*b* takes the place of cable 28 in Figs. 1 and 6 and is normally supported by the arm 26 of a release device 24. The cable 28*b* thus normally holds the pulley 31*b* in the position shown in Fig. 9.

To operate the pulley, I provide a cable 30*b* which is fastened at one end to the pulley and then passes about the pulley and through the fork 86. The opposite end of the cable 30*b* carries a weighted plunger 88 which has a sliding fit in the cylinder 89. Thus, when the cable 28*b* is released the weight of plunger 88 will turn the pulley 31*b* and open the selector valve 20. At the same time the plunger will compress air in the cylinder 89 and a pipe 61*b* running to the release device 62*a*, thereby effecting release of the weight 73 which, in turn, will cause discharge of cylinders 12 into the line 16. In this structure it will be observed that the bellows 56 and associated parts are eliminated thereby effecting economy in cost of apparatus.

The purpose of using a semi-circular pulley in place of a spiral pulley is to keep the point at which cable 30*b* departs from the pulley 31*b* at all times substantially on the vertical axis of the plunger 88 and thereby prevent binding of the plunger in the cylinder. As the pulley turns the cable 30*b* may move freely out of the fork 86, pushing the cable 28*b* out of the way should it chance to remain in the fork when released from arm 26.

In the drawings I have shown a weight 73 directly operating both of the cylinders 12. Obviously where a battery of a number of cylinders is employed the weight may directly actuate the discharge head of only one or two of the cylinders and the fluid thus released can then be utilized to effect the discharge of the rest of the cylinders, in accordance with practice well known in the art.

While I have described a preferred embodiment and certain modifications thereof it will be understood that these are to be taken as illustrative and not limitative and that various changes may

be made in form, construction and arrangement of parts without departing from the spirit and scope of my invention as set forth in the claims.

I claim:

1. In a fire extinguishing apparatus including a conduit having a discharge outlet and a valve normally closing the outlet, means for opening the valve, and a controller for said means operable by fluid pressure, a normally expanded bellows of heat conducting material adjacent the outlet containing an expansible fluid, a fluid conduit connecting the bellows and said controller, and a cage limiting expansion of the bellows.

2. In a fire extinguishing apparatus of the character described, a source of fire extinguishing fluid under pressure, a conduit leading therefrom and having a discharge outlet, closure means normally preventing admission of fluid from said source into the conduit, a valve normally closing said outlet, said valve having a stem rotatable to open the valve, means for rotating the stem to open the valve, means adjacent the valve providing a pneumatic chamber of variable capacity, a cam fixed to the stem, means controlled by the cam for effecting a sudden change in capacity of said chamber as the valve is opened so as to produce a pneumatic impulse, and means controlled by said impulse for opening the closure means.

3. In a fire extinguishing apparatus of the character described, a source of fire extinguishing fluid under pressure, a conduit leading therefrom and having a plurality of outlets, a main valve normally preventing admission of fluid from said source into the conduit, a valve for each outlet comprising a closure element normally held in seated position to close the outlet, means for positively and individually withdrawing each closure element from its seat, means operated by said withdrawing means to generate a fluid impulse as the closure element is being unseated, and means controlled by said fluid impulse for opening the main valve.

4. In a fire extinguishing apparatus of the character described, a source of fire extinguishing fluid under pressure, a conduit leading therefrom and having a plurality of outlets, a main valve normally preventing admission of fluid from said source into the conduit, opening means tending to open the main valve, a device normally restraining said opening means but operable by variation of fluid pressure to release the opening means, a valve for each of said outlets comprising a closure element normally in a position closing the outlet, conducting means leading from the restraining device to said outlet valves, means controlled by surrounding atmospheric conditions at each outlet for forcing open the closure element of the outlet, and means operated by the forcing means for generating a fluid impulse in said conducting means to operate the restraining device.

5. In a fire extinguishing apparatus of the character described, a source of fire extinguishing fluid under pressure, a conduit leading therefrom and having a plurality of outlets, a main valve normally preventing admission of fluid from said source into the conduit, opening means tending to open the main valve, a device normally restraining said opening means but operable by variation of fluid pressure to release the opening means, a valve for each of said outlets comprising a closure element normally in a position closing the outlet, conducting means leading from the restraining device to said outlet valves, means controlled by temperature conditions at each outlet for forcing open the closure element of the outlet, and means operated by the forcing means for generating a fluid impulse in said conducting means to operate the restraining device.

6. In a fire extinguishing apparatus of the character described, a source of fire extinguishing fluid under pressure, a conduit leading therefrom and having a plurality of outlets, a main valve normally preventing admission of fluid from said source into the conduit, opening means tending to open the main valve, a device normally restraining said opening means but operable by variation of fluid pressure to release the opening means, a valve for each of said outlets comprising a closure element normally in a position closing the outlet, conducting means leading from the restraining device to said outlet valves, means controlled by surrounding pressure conditions at each outlet for forcing open the closure element of the outlet, and means operated by the forcing means for generating a fluid impulse in said conducting means to operate the restraining device.

7. In a fire extinguishing apparatus of the character described, a source of fire extinguishing fluid under pressure, a conduit leading therefrom and having a plurality of outlets, a main valve normally preventing admission of fluid from said source into the conduit, opening means tending to open the main valve, a device normally restraining said opening means but operable by variation of fluid pressure to release the opening means, a valve for each of said outlets comprising a closure element normally in a position closing the outlet, conducting means leading from the restraining device to said outlet valves, means controlled by atmospheric pressure conditions as well as by thermal conditions at each outlet for forcing open the closure element of the outlet, and means operated by the forcing means for generating a fluid impulse in said conducting means to operate the restraining device.

8. In a fire extinguishing apparatus of the character described, a source of fire extinguishing fluid under pressure, a conduit leading therefrom and having a discharge outlet, a main valve normally preventing admission of fluid from said source into the conduit, an outlet valve comprising a closure element normally held in a position closing said outlet, means for positively forcing the closure element to open position, a fluid reservoir adjacent the outlet valve, a duct leading therefrom to a point near the main valve, means controlled by the opening means for producing a sudden expansion of the reservoir as the valve is opened and thereby produce a suction impulse in the duct, and means controlled by said suction impulse for opening the main valve.

9. In a fire extinguishing apparatus of the character described, a source of fire extinguishing fluid under pressure, a conduit leading therefrom and having a discharge outlet, a main valve normally preventing admission of fluid from said source into the conduit, an outlet valve comprising a closure element normally held in a position to close said outlet, gravity means for moving said closure element to open said outlet, said gravity means comprising an actuating weight, a cylinder in which the weight slides as a plunger thereby producing a pneumatic impulse as the outlet valve is opened, means normally restraining operation of the gravity means, means for releasing the gravity means from the restraining means whereby the gravity means will move said closure

element to open position and produce such pneumatic impulse, and means controlled by such pneumatic impulse for opening the main valve.

10. In a fire extinguishing apparatus of the character described, a source of fire extinguishing fluid under pressure, a conduit leading therefrom and having a discharge outlet, a main valve normally preventing admission of fluid from said source into the conduit, an outlet valve comprising a closure element normally held in position to close said outlet, a fluid reservoir adjacent the valve, a duct leading therefrom to a point near the closure means, impacting means constructed and arranged to force the closure element to a position opening the outlet and simultaneously to produce a sudden variation in volume of the reservoir thereby producing a fluid impulse in the duct as the outlet is opened, and means controlled by said impulse for opening the closure means.

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