May 24, 1949. H. N. RIDER 2,471,241

FLUID VALVE AND REMOTE-CONTROL SYSTEM

Original Filed Dec. 20, 1944 3 Sheets-Sheet 1

FIG. 2.

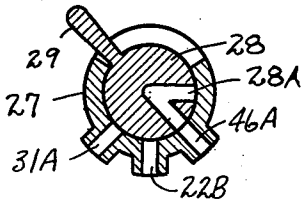


FIG. 3.

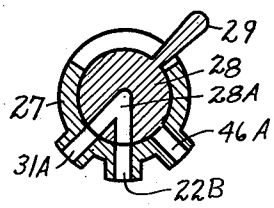


FIG. 4.

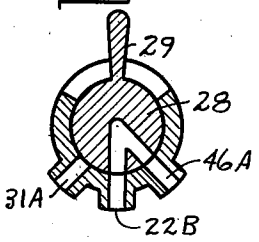
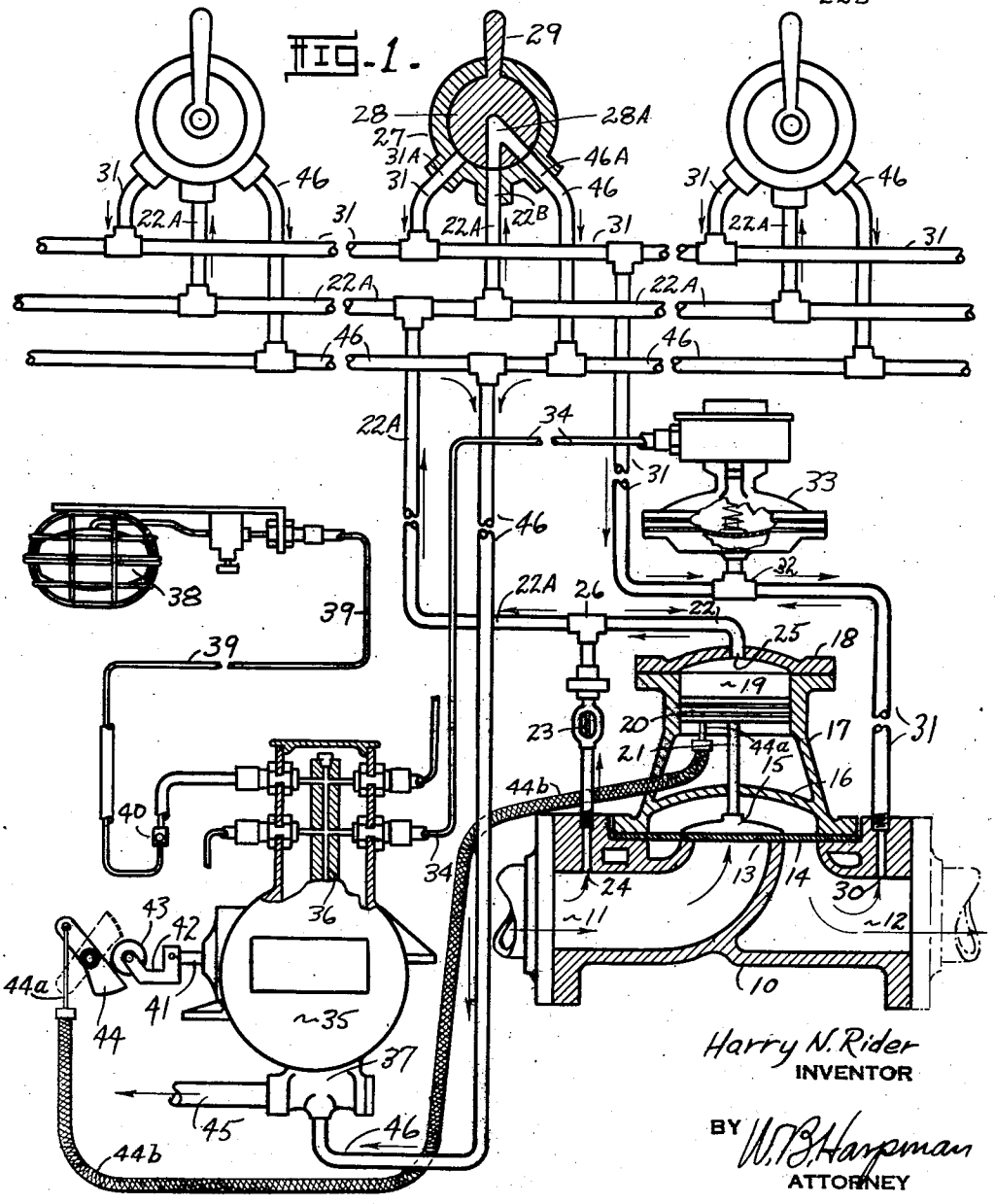


FIG. 1.



Harry N. Rider
INVENTOR

BY W. B. Harpman
ATTORNEY

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FLUID VALVE AND REMOTE-CONTROL SYSTEM

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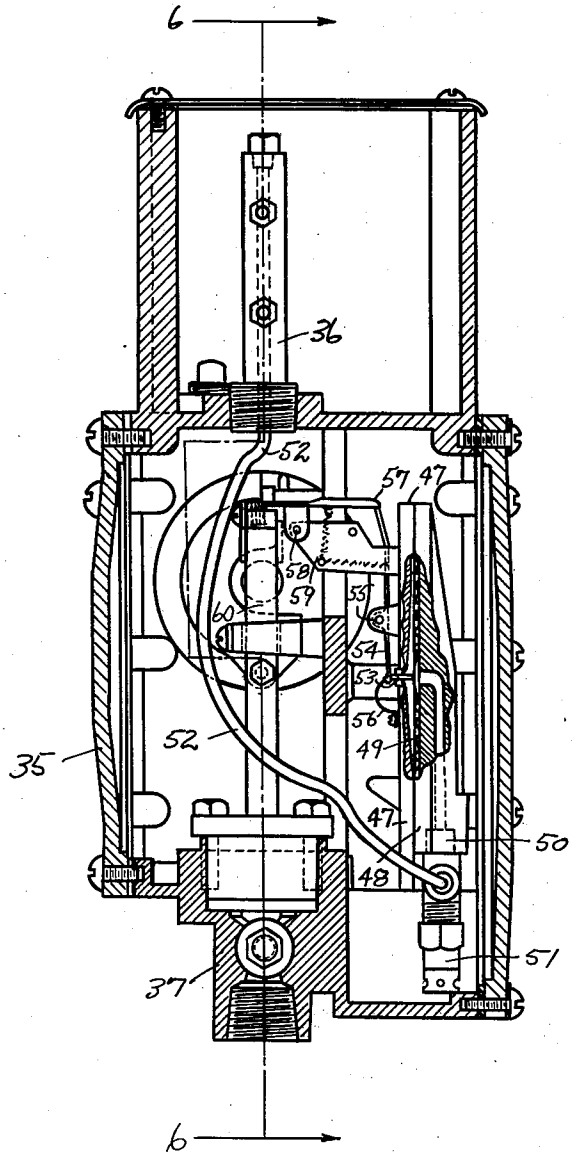
Fig. 5.



Harry N. Rider
INVENTOR

BY W. B. Harpman
ATTORNEY

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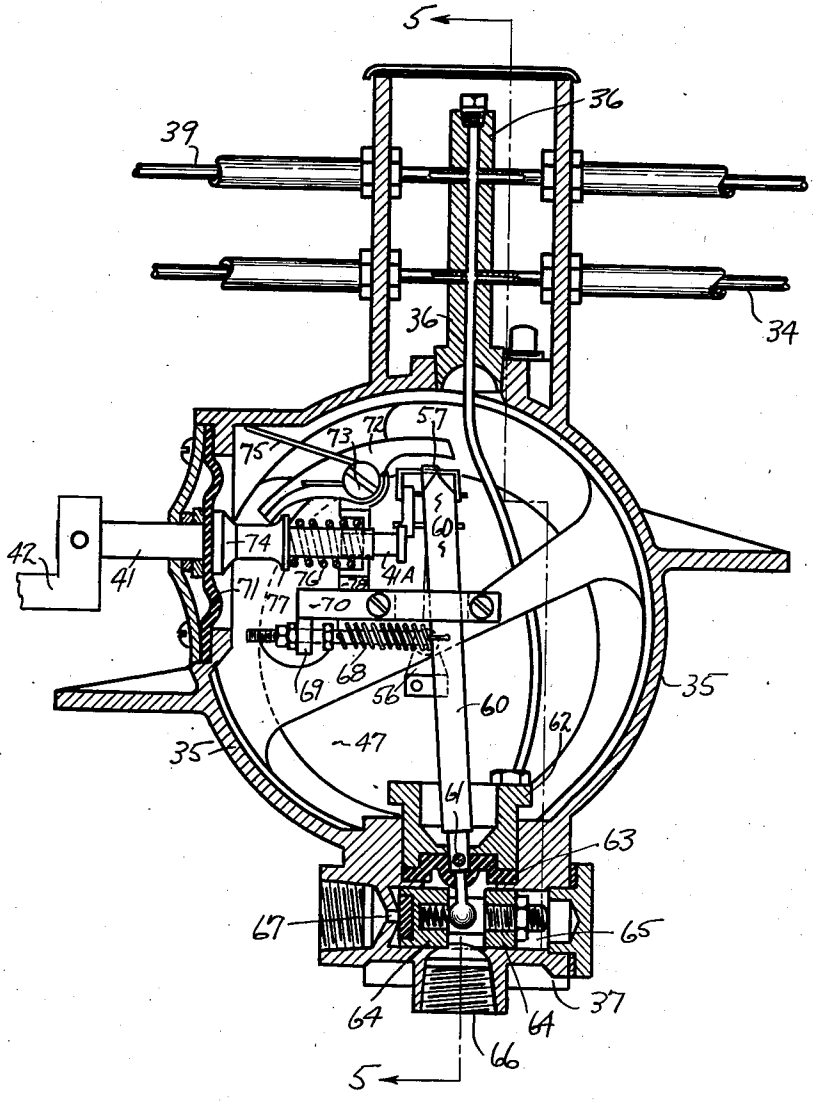
FIG. 6.



Harry N. Rider
INVENTOR

BY W. B. Harpman
ATTORNEY

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2,471,241

UNITED STATES PATENT OFFICE

2,471,241

FLUID VALVE AND REMOTE-CONTROL SYSTEM

Harry N. Rider, Youngstown, Ohio, assignor to "Automatic" Sprinkler Company of America, Youngstown, Ohio, a corporation of Delaware

Substituted for application Serial No. 569,031, December 20, 1944. This application January 14, 1948, Serial No. 2,166

4 Claims. (Cl. 169—5)

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This invention relates to a fluid actuated valve and a remote control system therefor.

The principal object of the invention is the provision of a fluid actuated valve and remotely positioned means for effectively controlling the operation thereof.

A further object of the invention is the provision of a fluid actuated valve and heat actuated automatic means for operating the same.

A still further object of the invention is the provision of a fluid actuated valve and manually operated means for operating the same.

A still further object of the invention is the provision of a fluid actuated valve and means for actuating the same including a heat actuated fluid release mechanism and means for resetting the said fluid release mechanism.

The fluid actuated valve and the manual and heat actuated automatic means for effecting its operation shown and described herein have been designed to provide a practical and efficient fluid control valve such as may be used, for example, for controlling the fluid supply source of a sprinkler system. The fluid actuated valve is so designed and connected with the actuating mechanisms used in conjunction therewith as to enable it to be remotely actuated to open or closed position by means of one or more manual control stations which may be and preferably are remotely positioned with respect to the fluid control valve itself. The fluid control valve is also connected with automatically acting heat actuated mechanisms that open the said valve upon detection of fire. The fluid control valve may be closed and the heat actuated mechanisms reset for subsequent operation by the manual operation of any one of the remotely positioned manual control stations provided. The fluid control valve and its associated controlling and actuating mechanisms are actuated both manually and automatically and provide a simple and efficient fire protection control valve positive in operation both with respect to the opening and closing thereof and particularly adapted for installation on shipboard where the several manual control stations provided may be used to manually open the remotely situated fluid control valve upon the observance of fire and to close the said control valve whether or not it was opened by the manual control stations or by the automatic heat actuated mechanisms also connected therewith.

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed can be made within the scope of what is claimed without departing from the spirit of the invention.

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The present application is a substitute for application Serial No. 569,031, filed December 20, 1944, now abandoned.

The invention is illustrated in the accompanying drawing, wherein—

Figure 1 is a schematic illustration of the fluid control valve and associated operating mechanisms, both manual and automatic.

Figure 2 is a cross sectional side elevation of one of the manual control valves illustrated in Figure 1 and shows the same in reset position.

Figure 3 is a cross sectional side elevation of one of the manual control valves illustrated in Figure 1 and shows the same in valve opening position.

Figure 4 is a cross sectional side elevation of one of the manual control valves illustrated in Figure 1 and shows the same in normal non-actuating position.

Figure 5 is a cross sectional side elevation of a portion of the device illustrated in Figure 1 and taken on line 5—5 of Figure 6.

Figure 6 is a cross sectional elevation taken on lines 6—6 of Figure 5.

By referring to the drawing and Figure 1 in particular, it will be seen that a fluid actuated fluid control valve 10 includes an inlet 11 and an outlet 12 connected by means of an orifice 13 subject to the control of a diaphragm 14 and plunger 15. The diaphragm 14 and plunger 15 are positioned on the fluid actuated fluid control valve 10 by means of a valve cap 16 which incorporates as an integral part thereof a superstructure 17 and superstructure cap 18 to form a cylinder 19 in which a piston 20 is operatively positioned. The piston 20 is connected to the plunger 15 by means of a connecting rod 21 so that movement of the piston 20 is directly imparted to the plunger 15. It will thus be seen that the diaphragm 14, when held in the position illustrated, by means of the plunger 15 and associated piston 20, serves to close the orifice 13 between the inlet 11 and fluid outlet 12 of the fluid actuated fluid control valve 10. It will also be seen that in order that the diaphragm 14 be retained in the position illustrated closing the orifice 13, fluid must be introduced into the cylinder 19 above the piston 20 and that the area of the cylinder 19 must be greater than the area of the orifice 13 of the valve 10. In order that fluid can

and will be introduced into the cylinder 19, a tube 22 incorporating a restriction 23 is connected between an opening 24 in the inlet portion 11 of the valve 10 and an opening 25 in the superstructure cap 18 which forms the head of the cylinder 19. A T fitting 26 is connected in the tube 22 between the restriction 23 and the cylinder 19. A tube 22A communicates with the T fitting 26 and with one or more remote control station valves 27 by means of which the fluid actuated fluid control valve 10 may be caused to open or close. The remote control valve 27 is provided with a rotatable valve element 28 which is provided with a handle 29 so that the valve element 28 may be manually moved thereby.

By referring again to the fluid actuated fluid control valve 10 it will be seen that an opening 30 therein communicates with the outlet portion 12 thereof and that a tube 31 is in communication therewith and that the tube 31 also extends to each of the remote control station valves 27. A T fitting 32 connected in the tube 31 provides for the connection therewith of a pneumatic impulse originating device 33 such as is known in the art. The pneumatic impulse originating device 33 includes a diaphragm which translates fluid pressure on one side thereof as in the tube 31 to an increased air pressure on the other side thereof which is conveyed from the pneumatic impulse originating device 33 by means of air tubing 34 in communication therewith. The air tube 34 also communicates with a fluid release valve and actuating mechanism, generally indicated by the numeral 35, and particularly with a manifold 36 thereof so that an increase in air pressure in the air tubing 34 as originated by the pneumatic impulse originating device 33 may be used to actuate the fluid release valve and actuating mechanism 35. The fluid release valve and actuating mechanism 35 is well known in the art and constitutes the subject matter of U. S. Patent No. 2,349,464, issued May 23, 1944, to Harry N. Rider and Fred G. Dieter. The fluid release valve actuating mechanism 35 serves to open a valve portion 37 thereof upon an increase of air pressure in its operating mechanism. This increase of air pressure may also originate automatically as from a heat actuated device 38, shown connected by means of air tubing 39, to the manifold 36 of the fluid release valve and actuating mechanism 35. In this connection it will be observed that a ball check valve 40 is shown positioned in the air tubing 39 so that when a plurality of the heat actuated devices 38 are employed the increase in air pressure originating in one or more of them will be prevented by the ball check valve 40 from flowing back into others of the heat actuated devices 38 and thus adversely affecting the pneumatic operation of the fluid release valve and actuating mechanism 35. The fluid release valve and actuating mechanism 35 is provided with a reset pin 41 to which is attached a pivot arm 42 carrying a roller 43 which is adapted to be actuated by means of a pivoted lever 44 connected directly or indirectly to the connecting rod 21 heretofore referred to in connection with the piston 20 and the plunger 15 of the fluid actuated fluid control valve 10. In the symbolic illustration comprising Figure 1, a flexible sheath 44B encloses a movable flexible shaft 44A which comprises a connection between the piston 20 and the connecting rod 21 and the pivoted lever 44. The pivoted lever 44, when actuated by the movable flexible shaft 44A, serves to reset the fluid release valve and actuating mechanism 35 after it has been operated pneumatically either by the heat actuated device 38 or the pneumatic impulse originating device 33, the latter operation being contingent upon manual operation of one of the remote control station valves 27. The fluid valve portion 37 of the fluid release valve and actuating mechanism 35 is connected to a drain by means of a tube 45 and to the remote control station valves 27 by means of a tube 46.

When the fluid actuated fluid control valve 10 is in normal or closed position, as shown in Figure 1, the normal fluid pressure in the inlet 11 thereof is in communication, by way of the tube 22 and the restriction 23 therein, with the cylinder 19 and hence causes the piston 20 to hold the diaphragm 14 so as to effectively close the orifice 13 and prevent the flow of fluid through the valve 10. The fluid from the inlet 11 is also in communication by way of the tube 22A with each of the remote control station valves 27 and specifically with the orifice 22B of each. The remote control station valves 27, shown in cross section in Figure 1 with the handle 29 thereof standing vertically, are in normal position, the valve element 28 thereof and the passageway 28A therein serving to establish communication between the orifice 22B thereof and an orifice 46A thereof, which orifice 46A is in communication with the tube 46 which, as heretofore described, is also in communication with the fluid valve 37 of the fluid release valve and actuating mechanism 35, which valve 37 is normally closed. Therefore, fluid passes from the inlet 11 of the fluid actuated fluid control valve 10 and is in communication by way of the remote control station valves 27 with the normally closed valve 37 of the fluid release valve and actuating mechanism. If a fire occurs in the area subject to the control of the heat actuated device 38, the resulting increase in air pressure in the heat actuated device 38 will operate the fluid release valve and actuating mechanism 35 and cause the quick opening of the valve 37 thereof thereby placing the tube 46 in communication with the drain tube 45 and effectively lowering the fluid pressure in the tube 46 and the tubes 22A and that portion of the tube 22 above the restriction 23 and hence in the cylinder 19 which will effectively destroy the differential heretofore existing therein and permit the fluid in the inlet 11 to move the diaphragm 14 and the plunger 15 and piston 20 upward to open the orifice 13 and permit the free flow of fluid from the inlet 11 to the outlet 12 of the fluid actuated fluid control valve 10. When it is desired to close the valve 10, this may be accomplished by the manual actuation of any one of the remote control station valves 27 which, as heretofore explained, are preferably remotely located with respect to the valve 10. This is done by the manual movement of the handle 29 on the valve element 28 to the closing or reset position as illustrated in Figure 2 of the drawings wherein a cross sectional side elevation of one of the remote control station valves 27 in this closing or resetting position is illustrated.

By referring to Figure 2 of the drawing, it will be observed that the handle 29 has been moved to the left thereby partially rotating the valve element 28 and causing the passageway 28A therein to move away from its normal position whereby it establishes communication between the orifices 22B and 46A, as shown in Figure 1, and also in Figure 4 of the drawings. This closing of the normal passageway existing through the remote control station valves 27 between the tubes

22A and the tube 46 stops the further relief of fluid pressure through the tube 22A and permits the fluid pressure from the inlet 11 to again build up sufficient differential in the cylinder 19 to move the piston 20 and hence the plunger 15 downwardly upon the diaphragm 14 and thereby close the orifice 13 and hence the flow of fluid through the valve 10. When this occurs the motion of the connecting rod 21 which connects the piston 20 with the plunger 15 is utilized as heretofore explained to move the reset pin 41 of the fluid release valve and actuating mechanism 35 and thereby close the valve 37 thereof. When this has occurred the handle 29 of the remote control station valve 27 is returned either manually or by means of springs (not shown) to its normal (upright) position thereby re-establishing communication between the tube 22A and the tube 46. The system is then in condition for subsequent operation.

In the event that a fire is observed before the same is detected by the heat actuated devices 38 and the valve operated as a result of the operation of the fluid release valve and actuating mechanism 35 as just described, any one of the remote control valves 27 may be utilized to cause the opening of the fluid actuated fluid control valve 10. This is accomplished by the movement of the handle 29 of any one of the remote control station valves 27 to the right as indicated in Figure 3 of the drawings wherein a cross sectional illustration of a valve 27 in this position will be seen. By referring thereto it will be observed that when the handle 29 is moved to the right the passageway 28A in the rotatable valve element 28 establishes communication between the orifice 22B and an orifice 31A of the remote control station valve 27 and as the orifice 31A is in communication with the tube 31, which is also in communication with the outlet portion 12 of the fluid actuated fluid control valve 10, the resulting action is to relieve the fluid pressure in the tube 22A and that portion of the tube 22 above the restriction 23 and hence in the cylinder 19 and direct that fluid into the outlet portion 12 of the valve 10 and at the same time cause the actuation of the pneumatic impulse originating device 33. The relief of the fluid pressure in the cylinder 19 will permit the fluid pressure in the inlet 11 of the valve 10 to force the diaphragm 14 and the plunger 15 and the piston 20 upwardly and hence open the fluid passageway through the orifice 13 of the valve 10 and permit the free flow of fluid therethrough. Simultaneously, the diaphragm in the pneumatic impulse originating device 33 will translate the fluid pressure thus introduced into the line 31 from the line 22A, and the inlet orifice 11 of the valve 10, into an increase in air pressure in the tubing 34 which in turn will actuate the fluid release valve and actuating mechanism 35 and cause the valve portion 37 thereof to be opened. Thus, when this action occurs, which is simultaneous with the opening of the valve 10, the handle 29 of the remote control station valve 27 may be released or returned to the normal position, as illustrated in Figures 1 and 4, without affecting the operation in any manner, as the relief of pressure will continue through the tubes 22A and the pipes 46 and 45, the valve 37 being open by reason of the tripping of the fluid release valve and actuating mechanism. This action of tripping the pneumatic impulse originating device 33 occurs because the fluid pressure in the inlet 11 of the valve 10 is always greater than the fluid pressure

in the outlet 12 thereof and the pressure differentiation actuates the diaphragm in the pneumatic impulse originating device 33.

In order to reset the valve 10, the handle 29 of the remote control valve 27 is moved to the left, as previously described in connection with Figure 2 of the drawings, and as this action causes the rotatable valve element 28 to close the orifice 22B and hence the communication through the line 22A, the fluid pressure from the inlet 11 of the valve 10 again re-establishes itself in the cylinder 19 and hence moves the piston 20, the connecting rod 21 and the plunger 15 down upon the diaphragm 14 to cause it to close the orifice 13 of the valve 10 and hence stop the further flow of fluid therethrough. The downward travel of the piston 20 moves a flexible shaft 44A which is enclosed in a flexible sheath 44B and thereby moves the pivoted lever 44 and causes the reset pin 41 of the fluid release valve and actuating mechanism 35 to reset and hence close the valve 37 thereof. The system is again in condition for subsequent operation either manual or automatic.

The fluid release valve and actuating mechanism 35 forms an integral part of the remote control system for the fluid valve 10, as the heat actuated devices 38 actuate the fluid release valve and actuating mechanism 35 to effect the automatic actuation of the valve in the event of fire. The fluid release valve and actuating mechanism 35 is also automatically tripped by means of the pneumatic impulse originating device 33 at such time as the valve 10 is caused to open by the manual actuation of one of the remote control station valves 27.

By referring to Figures 5 and 6, detailed illustrations of the fluid release valve and actuating mechanisms may be seen. In Figure 5 a housing 35 from which the valve portion 37 depends will be seen to enclose a diaphragm unit comprising a pair of diaphragm enclosing discs 47 and 48 having a diaphragm 49 positioned therebetween. It will be observed that the diaphragm disc 48 is provided with a drilled and tapped opening 50 in which a vent body 51 is threadably engaged. The lowermost portion of the vent body 51 is filled with desirable packing material and the vent itself forms a slow acting vent in communication with the diaphragm case 48. In communication with the vent body 51 there is a tube 52 which extends upwardly therefrom and into the manifold 36 formed on the uppermost surface of the housing 35.

In order that movement imparted to a bushing pin 53 by the diaphragm 49, as in response to a pneumatic impulse generated by one of the heat actuated devices 38 in communication with the diaphragm unit, may be utilized in operating the relief valve 37, an operating lever 54 is pivoted to the diaphragm case 47 by means of a pivot 55. The lowermost end of the operating lever rests against the outermost end of the bushing pin 53 and is normally held in that relation by means of a small strip spring 56, one end of which is also affixed to the diaphragm case 47. The uppermost end of the operating lever 54 terminates beneath a fulcrum lever 57 which in turn is pivoted by means of a pivot 58 to a bracket 59 also formed on the diaphragm case 47. The outermost end of the fulcrum lever 57 is, as best illustrated in Figure 6, provided with a downturned tapered end section which forms a restraining latch for a valve lever 60, which valve lever 60 is pivoted by means of a pivot 61 to a gland member 62 which in connection with a flexible gland 63 through

which the valve lever passes, forms a closure between the fluid relief valve 37 and the remainder of the release device.

Still referring to Figure 6 wherein the details of the relief valve 37 are more clearly illustrated, it will be observed that a slidable valve element 64 is positioned in a cylindrical valve chamber which is located within the relief valve structure 37. The chamber 65 communicates through an opening 66 with the tubular connection 46 heretofore described as illustrated in Figure 1. The valve chamber 65 communicates at one end thereof with a drilled and tapped restricted opening 67 which comprises the relief opening from which fluid pressure is exhausted at such time as the relief valve 37 is open. It will be observed that the fluid pressure entering the valve chamber 65 through the drilled and tapped opening 66 which is in communication with the tubular connection 46, tends to retain the freely moving, unpacked valve element 64 in closed position against the only outlet and in order that the valve element 64 may be moved to open position, motion imparted to the valve lever 60 must overcome the fluid pressure holding the valve element 64 against the outlet orifice 67. In order that this may be accomplished, a coil spring 68 is provided, one end of which engages an opening formed on the valve lever 60 and the other end of which is adjustably positioned with respect to a bracket 69 which forms a part of the housing 35. An extension 70 of the bracket 69 provides a guide and retaining member for the valve lever 60, as a slot formed therein defines an area in which the valve lever 60 may move. It will thus be seen that at such time as the bushing pin 53 moves outwardly from the diaphragm case 47 it engages, as has heretofore been described, the operating lever 54, pivoted upon the pivot 55 which causes the uppermost end thereof to move outwardly from underneath the fulcrum lever 57 which in turn permits the opposite end of the fulcrum lever 57 to move upwardly. This opposite end of the fulcrum lever comprises the downwardly depending tapered portion 51 (see Figure 6) which normally acts as a latch in restraining the valve lever 60 from movement, which movement opens the relief valve 37 and permits the relief of the fluid pressure in communication therewith, which fluid pressure normally holds the valve 10 closed.

In order that the device may be reset after operating, the reset rod 41 is provided, which reset rod is positioned through the housing 35 by means of a flexible diaphragm 71. The reset rod is provided at its innermost end with an adjustable resetting pin 41A. The resetting pin 41A is adapted to directly engage the valve lever 60 so as to move it into the position shown in Figure 6 in which the valve element 64 in the valve chamber 65 is in closed position. In order that the fulcrum lever 51 will be positively moved into latched position so that it serves as a latch restraining the valve lever 60 from movement as well as permitting the uppermost end of the operating lever 54 to move in under the one end thereof, a reset lever 72 is provided and is pivoted to a structural portion of the housing 35 by means of a pivot 73 and is so positioned that an end thereof slidably engages the reset rod 41 and is adapted to mount an inclined shoulder 74 formed thereon which imparts upward movement to one end of the reset lever 72 and downward movement to the opposite end, which opposite end is positioned directly over the fulcrum lever 57. A spring 75 is positioned about the pivot 73 and serves to normally retain the upper end of the reset lever 72 in elevated position with respect to the fulcrum lever 57. In order that the reset rod 41 may be moved outwardly after the resetting operation, a coil spring 76 is positioned thereabout and engages a collar 77 formed on the reset rod and an upwardly extending portion 78 of the bracket 70 through which the reset rod passes.

It will thus be seen that movement of the diaphragm 49 in response to a pneumatic impulse originated in a fire zone by one of the heat actuated devices 38 results in the movement of the operating lever 54, the fulcrum lever 57 which permits the valve lever 60 to be moved by the spring 68 which results in opening the valve element 64 in the valve chamber 65 of the relief valve 37 and the relief of fluid pressure in communication therewith.

It will thus be seen that the automatic operation of the fluid actuated fluid control valve 10 by means of the heat actuated device 38 is dependent upon the fluid release valve and actuating mechanism 35 just described, or upon the operation of one of the remote control station valves 27, as heretofore described.

It will thus be seen that a practical and simple fluid actuated fluid control valve and remote automatic heat actuated controlling system therefor has been devised which is particularly adapted for shipboard installation and which provides positive trouble free operation of a main sprinkler valve both automatically and manually with respect to both the opening and the closing of the main valve.

Having thus described my invention, what I claim is:

1. A fluid valve and remote control system therefor, said fluid valve including a diaphragm and pressure responsive means for operating the said diaphragm to close a fluid passageway through the said valve, means in communication with the said fluid valve and pressure responsive diaphragm operating means for normally maintaining fluid pressure in the said pressure responsive diaphragm operating means, manual and heat actuated relief valves in communication with said pressure responsive diaphragm operating means for relieving fluid pressure therefrom so as to permit the said fluid valve to open, heat actuated devices in communication with said heat actuated relief valve, said manual valve including a normally open channel establishing communication between the said diaphragm operating means and the said heat actuated relief valve, resetting mechanism on said heat actuated relief valve, and motion transmitting means connecting the said pressure responsive diaphragm operating means and the said resetting mechanism of the said heat actuated relief valve so that movement of the said pressure responsive diaphragm operating means may be used to reset the said heat actuated relief valve after operation.

2. A fluid actuated control valve and remote control system therefor, said fluid actuated valve including a diaphragm and pressure responsive means for operating the said diaphragm to close a fluid passageway through the said valve, means communicating with the inlet of the said control valve and pressure responsive diaphragm operating means for normally maintaining fluid pressure in the said pressure responsive diaphragm operating means, a remotely situated manual

control valve in communication with said pressure responsive diaphragm operating means and a normally closed heat actuated automatic relief valve in communication with said remotely situated manual control valve, the said remotely situated manual control valve normally forming an open channel to said heat actuated automatic relief valve, the said pressure responsive diaphragm operating means being responsive in operation to either the venting of pressure by the remotely situated manual control valve or the venting of pressure by the opening of the heat actuated automatic relief valve.

3. A fluid actuated control valve and control system therefor, said control system including a plurality of remote control station valves and a heat actuated fluid release valve in communication with and responsive to a plurality of heat actuated devices in a fire zone, the said fluid actuated control valve including a diaphragm for closing a fluid passageway therethrough and a diaphram operating mechanism of the differential type, means establishing restricted communication between the inlet of the said fluid actuated control valve and the said diaphragm operating mechanism, means establishing a communication channel between said diaphragm actuating means and each of the said remote control station valves and by way thereof with the said heat actuated fluid release valve, each of the said remote control station valves including means for venting pressure from said diaphragm operating mechanism, and for closing said communication channel, the said diaphragm operating mechanism responsive in opening operation to the relief of pressure and in closing operation to the increase of pressure.

4. In a fire extinguishing system including a fluid actuated main control valve responsive in

opening operation to relief of pressure in its operating mechanism and having a heat actuated automatic release valve for normally actuating the said main control valve in the event of fire, means establishing communication between the said main control valve and the automatic release valve, manual control means for actuating the said main control valve operatively connected in said communication means, said manual control means including a valve body having three orifices, and a rotatable valve element having a channel therein for connecting two of the said orifices at one time, the said communication means being normally maintained through two of the said orifices by the said channel in the rotatable valve element, said fluid actuated control valve normally responsive in opening operation to the opening of the said heat actuated automatic release valve and capable of opening actuation by the manual movement of the said rotatable valve element to relieve pressure in the communication means, by way of the third orifice, and capable of closing actuation by the manual movement of the said rotatable valve element to establish pressure in the said communication means.

HARRY N. RIDER.

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