Aug. 20, 1935. T. M. ALLAN 2,011,603

SPRINKLER SYSTEM ALARM ACCELERATING MEANS

Filed May 24, 1933

Fig. 2.

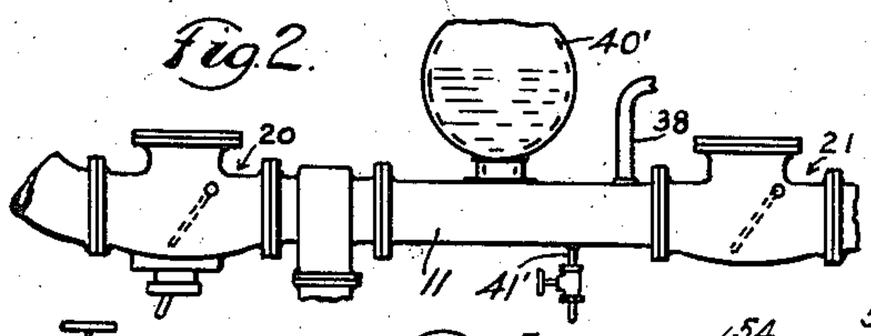

Fig. 3.

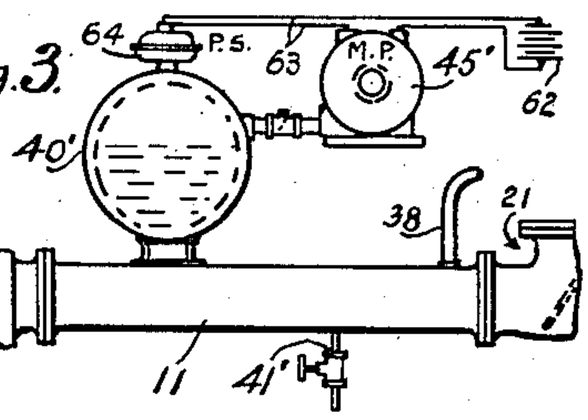

Fig. 1.

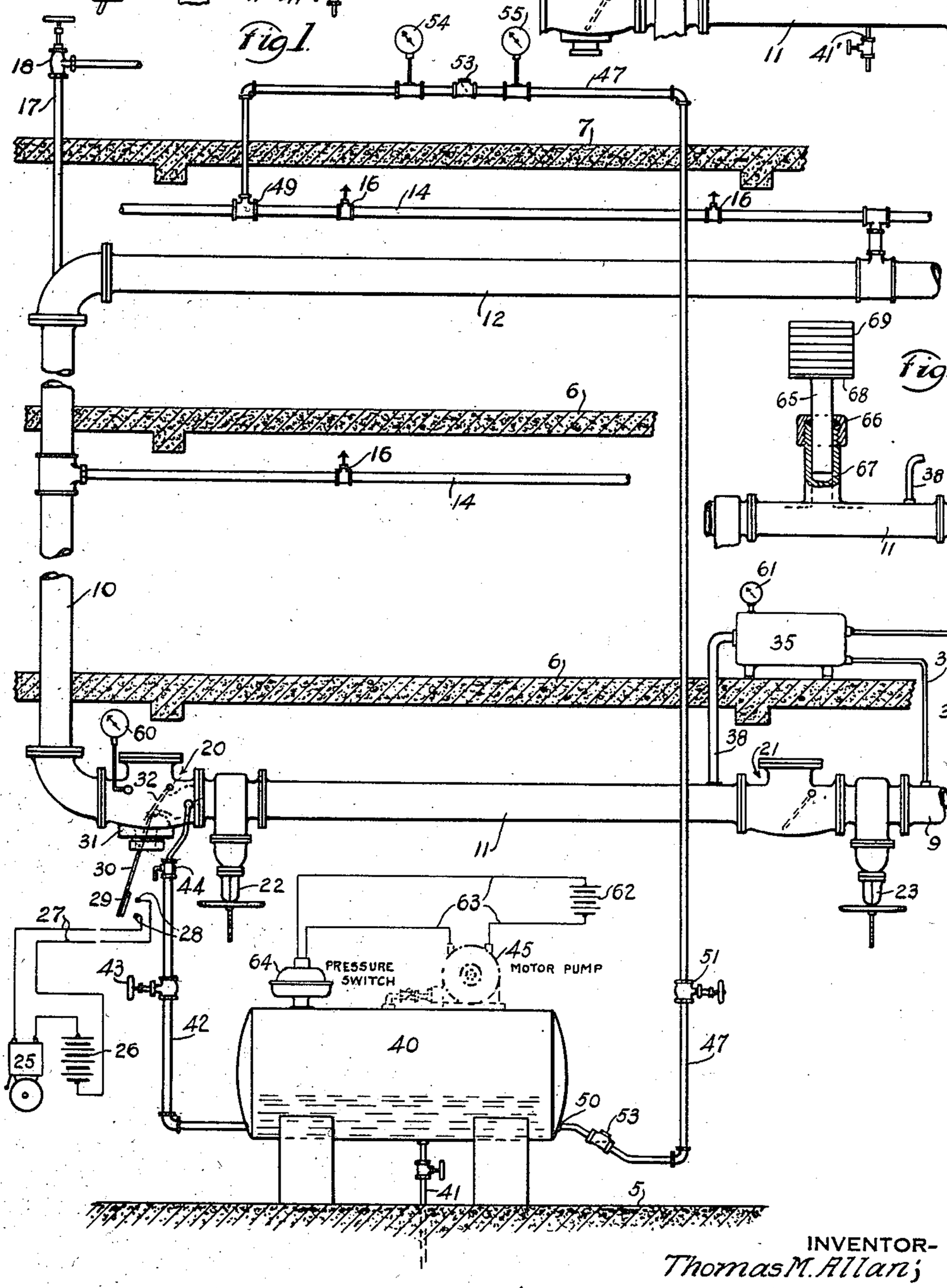

Fig. 4.

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SPRINKLER SYSTEM ALARM ACCELERATING MEANS

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18 Claims. (Cl. 169—23)

This invention relates to sprinkler systems, and alarm means therefor and to means for preventing false alarms by water hammer surges, and more particularly to valve operated alarm systems, though it is noted that in some of the claims the invention is not limited to alarm systems nor in some respects even to sprinkler systems.

One object of the invention is to provide an improved system of this kind wherein water hammer surges are prevented from sending false alarms by maintaining the pressure inside of the system high enough to prevent the opening, by water hammer, of an alarm operating check valve.

The invention is shown in combination with a sprinkler system conduit comprising a lower city-pressure portion, a sprinkler portion, and an intermediate expansion portion therebetween in which is disposed an alarm check-valve and a city check-valve opening toward the sprinkler portion, the alarm valve being nearest the sprinkler portion and controlling an alarm circuit.

Other objects of the invention are to provide a suitable means such as a pump means for forcing water under pressure from the city pressure portion into the intermediate portion between the check valve, to prevent water hammer surges from the city pressure portion from passing to the alarm valve and giving false alarms.

The pressure in said intermediate portion and the sprinkler portion is normally the same, and when the sprinkler heads first open, it takes some time for the pressure in the sprinkler portion to fall below that in the city pressure portion to cause flow to open the alarm valve to operate the alarm.

To prevent this delay is another object of the invention, and I provide a pressure tank adapted to retain compressed air in its upper part, and having a pressure pipe extending from its lower part to the conduit between the valves, and serving for maintaining pressure and quickly expanding the fluid volume between said check valves when a sprinkler discharges, and maintaining said pressure and continuing the expansion during initial discharge sufficiently long to open the alarm valve to operate the alarm, before water commences to flow from the city mains, thereby to prevent delay in operating the alarm.

Additional objects of the invention are to improve generally the simplicity and efficiency of such systems and to provide a simple apparatus of this kind which is economical and reliable in operation, and economical to manufacture and install.

Still other objects of the invention will appear as the description proceeds; and while herein details of the invention are described in the specification and some of the claims, the invention is not limited to these, since many and various changes may be made without departing from the scope of the invention as claimed in the broader claims.

In the accompanying drawing showing, by way of example, several of many possible embodiments of the invention,

Fig. 1 is a fragmental side elevation, partly in section, showing the system provided with an air pressure tank for supplying expanding-fluid pressure for initially operating the alarm valve, two devices being shown for supplying compressed air to the tank;

Figs. 2 and 3 are fragmental side elevations, of modifications, showing the air chambers for supplying said pressure; and

Fig. 4 is a fragmental elevation partly in section, showing another modification showing a weighted accumulator for supplying said pressure.

The principal features of the system will first be briefly indicated, after which the various features will be described in detail.

My invention, very briefly stated includes a sprinkler system comprising a conduit having a city pressure portion 9, a sprinkler portion 10, 12, and an intermediate expansion portion 11 therebetween in which are interposed alarm and city check-valves 20, 21 opening toward the sprinkler portion. An excess pressure pump 35 raises the pressure in the expansion portion 11 sufficiently to prevent the passage of water hammer surges to the alarm valve 20. An air pressure reservoir 40 communicates with said expansion portion 11 and is adapted, when a sprinkler discharges, to maintain pressure and quickly expand the fluid volume between said check valves a sufficient length of time to open the alarm valve and operate the alarm.

Now the invention will be described in detail.

My invention is embodied in a sprinkler system shown in combination with floors 5, 6 and ceiling 7 of a building and comprises a conduit 9, 10, 11, 12 adapted to receive water under pressure from a city main or other pressure supply and comprising a lower city pressure portion 9, a riser portion 10, an intermediate horizontal expansion or protective portion 11 therebetween, and an upper horizontal distributing portion 12.

Branch pipes 14, 14 supplied by the riser 10 and upper portion 12 have the usual sprinkler heads 15 therein; and a usual testing pipe 17 joining the upper part of the conduit has a gate valve 18 therein whereby water may be discharged for testing the system.

An alarm check-valve 20 and a city check-valve 21 in said intermediate expansion portion 11 adjacent to respective hand valves 22, 23, open toward the riser portion. The alarm valve 20 is nearest the riser portion 10 and controls an alarm circuit 25, 26, 27 having a switch 28, 29 therein controlled by a lever 30 intermediately fulcrumed in liquid-tight manner in the casing 31 of said alarm valve and engaging the movable valve member 32 and here shown as carrying the movable switch member 29 of said switch, said lever being operated by said member 32 to close the switch when sufficient water flows through the alarm valve.

A hydraulic excess pressure pump 35 having an exhaust pipe 36 and an inlet pipe 37, is connected to the city pressure portion 9 of the conduit, whereby the pump is fed and driven to draw water from the portion 9 and force it under pressure through a pressure pipe 38 into the expansion portion 11, whereby the pressure in the system, is raised sufficiently to prevent water hammer surges from the city pressure portion 9 from passing through the expansion portion 11 to the alarm valve 20 to send a false alarm.

With the system as thus far described in detail, should sprinkler heads 16 discharge, the pressure will be gradually lowered, thus starting the pump 35; but there will be several minutes before the pressure in the system becomes as low as the pressure on the city side of the city valve 21 and allows flow of the city water through the intermediate portion 11 into the system. Thus flow from the city pressure portion will not itself immediately open the alarm valve. Also since water is practically incompressible and the conduit portion 11 does not contract appreciably when said pressure is lowered, the elasticity of the water and conduit portion 11 will not cause any appreciable flow of water through the valve 20; and as the flow from the pump through the pressure pipe 38 is not sufficient to cause the alarm valve member 32 to operate the alarm, there is a need for some additional means to the system, as so far described, to open the alarm valve substantially as soon as the sprinklers open, so that the alarm will not be delayed for the several minutes until there is full flow from the city pressure portion 9.

To meet this need, I provide a means for maintaining the high pressure and quickly expanding the fluid volume between said check valves 20 and 21 when sprinkler heads discharge, and maintaining said pressure and continuing the expansion during initial discharge sufficiently long to open the alarm valve and operate the alarm.

Said expanding means comprises an air pressure tank or chamber 40 adapted to retain compressed air in its upper part at a pressure equal to that in the expansion portion 11 and having a drain valve 41, and a pressure pipe 42 extending from its lower part to the interior of the alarm valve casing 31 at the side of the member 32 toward the expansion portion 11. The pipe 42 is provided with a gate valve 43 and a stop cock 44, the latter being nearer the alarm valve, for convenience.

When sprinkler heads open, pressure in the conduit portions 10 and 12 immediately lowers; and the pressure in the portion 11 tends to lower, but is maintained by upward flow of water through the pipe 42, thus effecting a difference in pressures on both sides of the valve member 32. The thus maintained higher pressure in the portion 11 causes flow from portion 11 into the riser, thus opening the valve member 32, closing the switch 28, 29 and operating the alarm.

Means are provided for supplying compressed air to the upper part of said tank 40. This means may comprise a small air compressor 45 discharging into the tank, or may comprise a small air pipe 47 extending from an upper or the highest part of the system as at 49, to the lower part of the pressure tank, as at 50, and having therein an intermediate gate valve 51, and at its upper and lower parts, check valves 52 and 53 opening toward the tank. Pressure gauges 54, 55 communicate with this pipe adjacent to and on both sides of the upper check valve 53.

Said pipe 47, serves to conduct air to the tank from the previously empty system, when water initially forced therein by the city pressure and excess pressure pump drives the air from the system, thereby to compress the air in the tank, as will now be explained.

To compress the air in the tank 40 by means of the pipe 47, it is necessary to close the valve 23 and drain the system and the tank 40. The operator then closes valves 41, 43 and 44 and opens valve 51. Water is then admitted to the system by opening control valve 23. As the water flows into the system it forces the air upwardly and out through the pipe 47 connecting to the highest point 49 in the sprinkler system. From there the air passes through check valves 53 into the tank 40. When the system has been thus filled, the valves 43 and 44 are opened, thus supplying the tank with water at the same pressure carried in the portion 11 between the alarm check valve 20 and the city check valve 21. The valve 51 may then be tightly closed to prevent leakage of pressure back through the check valves 53 into the system.

If now a sprinkler head 16 opens, the pressure shown by the pressure gauge 60 will be reduced slightly and the accumulated pressure in the tank 40 will serve to almost instantly open the alarm check valve member 32 and thus operate the waterflow alarm.

Pressure gauges 54, 55, 60 and 61 show the pressures in various parts of the system by which the condition of the system can be ascertained.

Instead of means such as the tank 40 and pipe 42, I may provide an air-chamber 40′ on top of and communicating with the pipe 11, as in Fig. 2. To prime the air chamber, as in Fig. 2, with compressed air, the system may be drained, or the valves 22 and 23 may be closed and only the conduit portion 11 drained, through the drain valve 41′, thus draining the air chamber. Then water is turned into the system, or into the pipe 11, thus compressing air into the air chamber 40′.

The air chamber 40′ may be filled with compressed air by the air compressor 45′ as in Fig. 3, and such compressor may be used to keep the chamber fully charged with compressed air and replace any air which may be absorbed by the water.

Pumps 45, 45′ may be manually controlled, or they may be automatically controlled by the circuit 62, 63, 64 controlled by the pressure switch 64 controlled by pressure in the tank or chamber.

In the form of invention of Fig. 4, the elastic force for supplying the pressure to the conduit

portion 10 comprises a weighted plunger 65, slidable in a packing 66 at the upper end of a pipe 67 communicating with the conduit portion 11. This plunger 65 carries, at its upper end, a table 68 on which are placed weights 69. These weights are sufficient to balance the pressure in the system; and when in the position shown, they provide pressure sufficiently great, and sufficiently continued during discharge, to operate the valve 32 and switch member 29.

I claim as my invention:

1. A fire extinguishing system comprising a conduit having a water supply portion, a normally closed discharge portion, and an intermediate portion; a check valve separating the discharge portion from the intermediate portion, said valve opening in the direction of water flow to the discharge portion; alarm means operable by said water flow; means to establish a pressure higher than supply pressure in the intermediate portion normally and during the initial opening of a sprinkler head, said check valve and the intermediate portion constituting the only means of supplying water to the discharge portion when the discharge portion is opened.

2. A fire extinguishing system comprising a conduit having a water supply portion, a normally closed discharge portion, and an intermediate portion; a check valve separating the supply portion from the intermediate portion; a second check valve separating the intermediate portion from the discharge portion; both of said valves opening in the direction of flow to the discharge portion; alarm means operable by water flow from the intermediate portion to the discharge portion, means to establish a pressure higher than supply pressure in the conduit beyond the first mentioned check valve to thereby prevent operation of the alarm due to an increase in pressure in the supply line resulting from a water hammer; means to maintain said higher pressure in said intermediate portion to effect a difference in pressure on the opposite sides of said second valve and cause sufficient flow to operate said valve upon the initial opening of the discharge portion; the second mentioned check valve and the intermediate portion constituting the only means of supplying water to the discharge portion when the discharge portion is opened.

3. A fire extinguishing system comprising a conduit having a water supply portion, a discharge portion including normally closed sprinkler heads operable by fire conditions, and an intermediate portion; a check valve separating the supply portion from the intermediate portion; a second check valve separating the intermediate portion from the discharge portion; both of said valves opening in the direction of flow to the discharge portion; alarm means operable by flow to the discharge portion when the second valve is opened by such flow; means to establish a pressure higher than supply pressure in the conduit beyond the first mentioned check valve to thereby prevent operation of the alarm due to an increase in pressure in the supply line resulting from a water hammer; means for supplying additional water to said intermediate portion at said higher pressure in order to maintain said higher pressure in said intermediate portion to effect a difference in pressure on the opposite sides of said second valve and cause sufficient flow to operate said valve upon the initial opening of a sprinkler head; the second mentioned check valve and the intermediate portion constituting the only means of supplying water to the discharge portion when the discharge portion is opened.

4. A fire extinguishing system comprising a conduit having a water supply portion, a discharge portion including normally closed sprinkler heads operable by fire conditions, and an intermediate portion; a check valve separating the supply portion from the intermediate portion; an alarm operating check valve separating the intermediate portion from the discharge portion; both of said valves opening in the direction of flow to the discharge portion; alarm means operable by said alarm operating valve on its being opened by flow to the discharge portion, means to establish a pressure higher than supply pressure in the conduit beyond the first mentioned check valve to thereby prevent operation of the alarm due to an increase in pressure in the supply line resulting from a water hammer, means for supplying additional water to said intermediate portion at said higher pressure in order to maintain said higher pressure in said intermediate portion to effect a difference in pressure on the opposite sides of said alarm operating valve and cause sufficient flow to operate said valve upon the initial opening of a sprinkler head; the second mentioned check valve and the intermediate portion constituting the only means of supplying water to the discharge portion when the discharge portion is opened.

5. A fire extinguishing system having a water supply portion subject to water-hammer, a normally closed discharge portion and an intermediate portion; a check valve separating the supply portion from the intermediate portion; a second check valve separating the intermediate portion from the discharge portion; both valves opening toward the discharge portion; alarm means operated by said second valve during flow toward the discharge means; and means for maintaining pressure in the intermediate portion greater than that in the discharge and supply portions during initial discharge from the discharge portion; the second mentioned check valve and the intermediate portion constituting the only means of supplying water to the discharge portion when the discharge portion is opened.

6. A sprinkler system comprising a conduit having a supply portion, a normally closed discharge portion, and an intermediate portion therebetween constituting the only normal liquid-conducting communication between the supply and discharge portions; a check valve in said intermediate portion opening toward the discharge portion; an alarm operating means operated by flow from said valve to the discharge portion; means for raising the pressure in the intermediate portion above the pressure in the supply portion; and means communicating with said conduit between said valve and operating means for maintaining pressure in the conduit and adapted, during and after initial discharge, to cause yieldable pressure on the fluid between said check valve and discharge portion with sufficient pressure and duration to cause the fluid to operate the operating means.

7. A sprinkler system comprising, a conduit comprising a lower pressure portion, a riser portion having a normally closed discharge means, and an intermediate portion therebetween, said intermediate portion normally constituting the only flow-conducting passage between the pressure portion and the riser portion; an alarm check-valve and a city check-valve in said intermediate portion, both opening toward the

riser portion, the alarm valve being nearest the riser portion; an alarm means controlled by the alarm valve; pump means for forcing water under pressure from the city pressure portion into the intermediate portion, to raise the pressure in the expansion portion above the pressure in the city pressure portion, to prevent water hammer surges from the city pressure portion from passing the intermediate portion to the alarm valve; a pressure tank adapted to retain compressed air in its upper part, and having a pressure pipe extending from its lower part to the intermediate portion; a pipe extending from an upper part of the system to the pressure tank and having a normally closed gate valve therein; and a check valve in said pipe opening toward the tank.

8. In combination, a conduit comprising a supply portion, a normally closed discharge portion, and an intermediate portion therebetween; a check valve in said intermediate portion opening toward the discharge portion; a fluid-flow-operated translator operating means between said valve and the discharge portion; an air pressure chamber having its bottom part communicating with said conduit between said valve and operating means; a piston in the chamber; and means for supplying compressed air from the exterior of the conduit directly into the air-pressure chamber.

9. A sprinkler system comprising, a conduit comprising a pressure portion subject to water-hammer, and a sprinkler portion; a check-valve between said portions opening toward the sprinkler portion; and pump means operated by water from the pressure portion at normal pressure during absence of water hammer, for forcing water under pressure from the pressure portion into the sprinkle portion to raise the pressure in the sprinkle portion above that in the pressure portion to prevent water hammer surges from the city pressure portion from opening the alarm valve.

10. A sprinkler system comprising, a conduit comprising a pressure portion, a normally closed discharge portion, and an intermediate portion therebetween; check-valves in said intermediate portion opening toward the discharge portion; an alarm operated by the valve remote from the pressure portion; an air pressure tank having its lower part communicating with said intermediate portion; and means for supplying compressed air to the upper part of said tank; said means comprising a small air pipe extending from an upper or the highest part of the system to the lower part of the pressure tank and having therein an intermediate gate valve, and having, at its upper and lower parts, check valves opening toward the tank, and also having pressure gages adjacent to and on both sides of the upper check valve; said air pipe serving to conduct air to the tank from the previously empty system, when water forced therein from the pressure portion drives the air from the system through said pipe, thereby to compress the air in the tank.

11. In combination, a conduit comprising a supply portion, a discharge portion adapted to be closed, and an intermediate portion therebetween a check valve in said intermediate portion opening toward the discharge portion; a translator operating means operated by flow between said valve and the discharge portion; means for raising the pressure in the intermediate portion above that in the supply portion, a piston chamber communicating with said conduit between said valve and operating means; a piston in the chamber; and means for maintaining pressure on the piston.

12. A sprinkler system comprising a conduit having a supply portion, a normally closed discharge portion, and an intermediate portion therebetween constituting the only normal liquid-conducting communication between the supply and discharge portions; a check valve in said intermediate portion opening toward the discharge portion; an alarm operating means operated by flow from said valve to the discharge portion; means for raising the pressure in the intermediate portion above the pressure in the supply portion comprising a piston chamber communicating with said conduit between said valve and operating means; a piston in the chamber; and pressure means for maintaining pressure on the piston.

13. A sprinkler system comprising, a conduit comprising a pressure portion subject to water-hammer, and a sprinkler portion; a check-valve between said portions opening toward the sprinkler portion; and means controlled by the pressure in the pressure portion for automatically maintaining the pressure in the sprinkler portion above the pressure in the pressure portion in accordance with the latter pressure.

14. In combination, a water conduit comprising a supply portion, a normally closed discharge portion, and an intermediate portion therebetween; a check valve in said intermediate portion opening toward the discharge portion; a water-flow-operated translator operating means between said valve and the discharge portion; an air pressure chamber having its bottom part communicating with said conduit between said valve and operating means; and means for replacing air absorbed from the chamber by water and for supplying compressed air into the air-pressure chamber while forcing water therefrom.

15. A sprinkler system comprising, a water conduit comprising a pressure portion and a normally closed discharge portion; a check-valve between said portions opening toward the discharge portion; an alarm means operated by water flow to the discharge portion; an air pressure tank; means for establishing communication between the tank and the conduit on the discharge side of the valve; an air pipe extending from an upper part of the system to the pressure tank and having a valve interposed therein.

16. A sprinkler system comprising, a water conduit comprising a pressure portion and a normally closed discharge portion; a check-valve between said portions opening toward the discharge portion; an alarm means operated by water flow to the discharge portion; an air pressure tank; a valved pipe connecting the lower part of said tank with said conduit on the discharge side of the valve; an air pipe extending from an upper part of the system to the lower part of the pressure tank and having a valve interposed therein; said air pipe serving to conduct air to the tank from the previously empty air-filled system, when water forced into the system from the pressure portion drives the air from the system through said air pipe, into the tank, whereby additional air is forced into the tank and compressed therein, thereby increasing the weight of air in the tank above that originally in the tank when the system was empty, thereby increasing the capacity of the tank, without increasing the size and cost of the tank, thereby deferring the ex-

haustion of air in the tank from absorption by the water, thereby saving frequent refilling with air and permitting a smaller and cheaper tank than would be otherwise possible.

17. A sprinkler system comprising, a water conduit comprising a pressure portion, a normally closed discharge portion, and an intermediate portion therebetween; check-valves in said intermediate portion opening toward the discharge portion; an alarm operated by water flow to the discharge portion; an air pressure tank having its lower part communicating with said intermediate portion between said valves; and means for supplying compressed air to the upper part of said tank; said means comprising a small air pipe extending from an upper or the highest part of the system to the lower part of the pressure tank and having a valve interposed therein.

18. A sprinkler system comprising, a water conduit comprising a pressure portion, a normally closed discharge portion, and an intermediate portion therebetween; check-valves in said intermediate portion opening toward the discharge portion; an alarm operated by water flow to the discharge portion; an air pressure tank; a valved pipe connecting the lower part of the tank with said intermediate portion between said valves; a small air pipe extending from an upper or high part of the system to the pressure tank and having a valve interposed therein; said air pipe serving to conduct air to the tank from the previously empty air-filled system, when water forced into the system from the pressure portion drives the air from the system through said pipe, into the tank, whereby additional air is forced into the tank and compressed therein, thereby increasing the weight of air in the tank above that originally in the tank when the system was empty, thereby increasing the capacity of the tank, without increasing the size and cost of the tank, thereby deferring the exhaustion of air in the tank from absorption by the water.

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