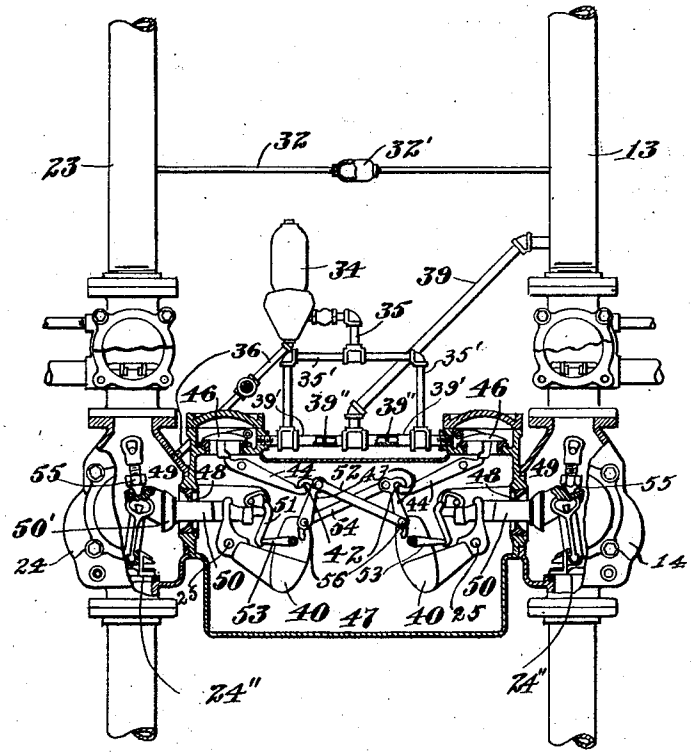
Nov. 17, 1925. 1,562,104

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DRY PIPE SPRINKLER SYSTEM

Filed June 22, 1923




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Patented Nov. 17, 1925. 1,562,104

# UNITED STATES PATENT OFFICE.

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## DRY-PIPE SPRINKLER SYSTEM.

Application filed June 22, 1923. Serial No. 647,173.

*To all whom it may concern:*

Be it known that I, ALBERT J. LOEPSINGER, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Dry-Pipe Sprinkler Systems, of which the following is a specification.

This invention relates to dry pipe systems for plural liquids such as may be used in automatic sprinkler fire extinguishing apparatus, discharging liquids operating by chemical reaction. Such systems employ two liquids, one of which is ordinarily an acid and the other an alkali, which react together immediately on mixing. For this reason and because the acid is corrosive it is especially desirable to employ the dry pipe principle, in which the pipes remain normally filled with air until a sprinkler opens from the heat of a fire, whereupon the reduction of air pressure automatically trips a valve for each liquid, to admit it to its system of piping leading to the sprinklers. In such cases it is highly desirable that both liquids, travelling through their respective systems, should arrive at the open head at the same instant, as the required effect is produced only by mixing, and as either alone may be seriously damaging to goods on which it may fall. It has, however, heretofore been found practically impossible to build two systems thus in parallel so that the valves will operate simultaneously. The present invention has for its object to provide means for the simultaneous operation of the separate valves controlling the liquids of such a system.

This object is accomplished by providing an operative connection between the two such that either may trip the other, or, more strictly, such that the tripping of either occasions the simultaneous tripping of the other. This is attained by providing a physical connection between operating parts of the two valves. The invention is here illustrated as it may be applied to a well-known type of dry pipe valve in which the liquid retaining clapper is held seated against the hydrostatic pressure of liquid by a system of linkage which is balanced in unstable equilibrium so that it yields upon slight dislodgment, and there is a weight, held suspended by air pressure in the distribution system, ready when released by fall of the air pressure to descend and knock the linkage system out of its said equilibrium, thus allowing the hydrostatic pressure to open the valve. The area of the yielding member which is exposed to the air pressure in the distribution system is so designed, with relation to the constant force applied to it by the weight, that the two are balanced when the air pressure has fallen, as it does upon the opening of a sprinkler anywhere in the system, to a certain predetermined value, which may, for example, be one-sixth of the normal hydrostatic pressure of liquid. With further falling the air pressure becomes too weak to hold the weight which thereupon descends, allowing the liquid valve to open. Where two such valves are side by side, each opening into its own distribution system, the fall of air may be a little slower in one system than in the other, or there may be slightly more friction in the linkage of one system than in the other, or, for other causes, the two, if entirely independent, may not have their valves tripped precisely simultaneously, even though the air release from them begins simultaneously on the opening of a double sprinkler head. It is a feature of the invention to make this action of the valves simultaneous, notwithstanding such differences; and this is accomplished by providing a mechanical connection between the parts which move when the valve is tripped. Specifically, the connection herein illustrated is one from the actuating weight of each trip mechanism to the trip mechanism of both valves, so that neither weight can descend in order to trip its valve without also tripping the other valve. In the form illustrated this end is attained by arranging the two valves in physical proximity to each other and providing a cross link, in addition to the hook link by which the weight has hitherto been suspended in its own valve, which cross link reaches across to the top of the hook link by which the weight of the other valve is suspended, in such manner that the weight, suspended in either valve, cannot descend without releasing the weight in the other valve. The arrangement is preferably such that the first weight, until it starts to fall, is restrained only by its own hook link; and so that when it starts

to fall its initial course does not materially increase its distance from the point of latch engagement, and this it starts to fall freely and gains some momentum; and so that thereafter the course in which it is constrained to move leads it away, gradually, from the point of latch engagement, whereby it pulls thereon with powerful advantage and so unlatches the hook link of the second weight with unfailing certainty, whether or not the air in its system has approached the necessary weakness to release its own weight. Usually the air pressure in the second system will have fallen greatly, and will be almost to the stage where tripping occurs, but in any event this kinetic force will immediately over-balance it if the type of latch be such as to require that, and the tripping of both valves will then occur with the simultaneity which results from the mechanical inter-connection of tripping members such that both move together and neither can move separately.

It will be understood that mechanical connections may be made in other respects between the parts which move when the tripping occurs, with similar results and within the scope of the invention. It will moreover, be understood that connections may be made in other than mechanical respects between the two dry pipe and distribution systems which are desired to act as a single system, in order to produce simultaneousness of tripping as, for example, fluid connections between the air systems of a mechanical valve or of a differential valve, or between the intermediate chambers of either kind of valve. The generic invention, and the other species thereof thus mentioned are set forth and claimed in three other applications for patent Serial Nos. 647,172, 647,174 and 647,175, filed coincidently herewith. It is intended that the present patent shall cover, by suitable expression in the appended claims, whatever features of patentable novelty exist in the general idea of a mechanical connection between parts of the tripping mechanism and especially in the specific applications thereof herein disclosed.

In the accompanying drawing:

The single figure illustrates, in elevation, the application of the invention to the pipes and dry pipe valves of a sprinkler system, the sprinklers not being shown, but it being understood that the distribution systems run in parallelism and that each sprinkler is fed from both, and opens both when it is released automatically in response to rise of temperature. But such details are not illustrated because they are well understood in the art.

Referring to the drawing, the figure shows the beginning of two liquid distribution systems, 13, 23, arranged in parallelism, such as may be used, the one for carrying an acid and the other for carrying an alkali liquid to sprinklers where the alkali and the acid are jetted together or otherwise mixed so as to produce a fire extinguishing liquid, gas or foam formation in the manner well known. The dry pipe valves 14 and 24 illustrated are also of a type which are well known and therefore do not need to be described in detail. In each case the liquid-retaining clapper 24″ is held closed by a system of linkage including a weighted lever 40 fulcrumed at 25 and so arranged that when set to be tripped its weight is at 42 held by a hook link 43 on the power end of an air trip lever 44, whose work end tends to open an air clapper valve 46 which is normally held on its seat by the air pressure in the system. Whenever this air pressure falls to a predetermined amount, as after the opening of a sprinkler, the weight and lever can lift this air clapper; and then the incidental tipping of the trip lever lets the hook 43 slip off from the lever, thus allowing the weight to fall. This weight, turning about 25, swings the base end of the strut 53 that has been on dead center and which has, through a plunger 50 and toggle 55, been holding the liquid valve closed. The toggle then yields and permits the liquid to rush into the distribution system.

The two connected dry pipe valves are shown arranged with their weighted levers 40 in a common chamber 47, which intervenes between intermediate chambers 49 of each valve, and connects them through openings 48 in which the toggle plungers 50 operate. The usual weighted levers 40 are arranged extending horizontally toward each other in substantially the same vertical plane, so that as they swing downward they swing away from each other. They may be so connected together, that both must swing simultaneously, but in any event the swinging of one pulls a latch release of the other. The connection comprises a pair of separate cross links 52 and 54, linking each weight to the supporting hook link 43 of the other weight; so that descent of either weight in direction to open its valve pulls the hook of the other weight off from its support 44 thus unlatching and permitting corresponding descent of the other weight. Accordingly if the air pressure on one of the air clapper valves 46 becomes reduced sufficiently to let its weight 40 lift that clapper, the descent of its weighted lever 40, simultaneously disengages the other weighted lever 40 from its air trip lever 44; and the falling of both together effects simultaneous opening of the liquid retaining valves. Since the pivot 56 between the weighted lever 40 and the link 52, or 54, is substantially on a line between the fulcrum 25 and the joint of this link to the hook link 43, the

initial movement of this pivot 56 is perpendicular to the longitudinal axis of the link 52 or 54, so that the initial movement of the latter is a mere swing about its connection with the hook link 43. Hence that connection offers no hindrance of the free falling of the weight 40. The latter at once acquires momentum, and as the pivot 56 traverses its arc about the point 25 as a center, it acts with crank like effect upon the connecting link 52, exerting a gradual and powerful pull on it. In this the static force due to gravity is supplemented in pulling the link 52, by whatever measure of momentum the weight 40 has acquired during its initial fall, before the pull on the link 52 becomes appreciable, thus insuring the unlatching of the hook link 43, even if the design makes it necessary to drag it up and out of a depression on the air lever 44.

In addition to this mechanical connection between the two valves, the connections 48 to the common chamber 47 enable the pressure in the intermediate chambers of the valves to be equalized. When the linkage is set to hold the liquid clappers closed, the openings 48 in the valve casings proper through which the toggle plungers 50 project from chambers 49 into 47 are large enough to allow free passage of fluid, and the contents are kept at atmospheric pressure by the usual ball drip valve (not shown) which closes when a rush of fluid through it begins. The chamber thus affords fluid connection such that if either liquid valve were tripped enough to leak, and the other still held, the inflow of liquid would quickly fill the chamber and apply high pressure to the underside of the hesitating air valve 46, thus insuring its immediate opening and the simultaneous full release of both liquid valves 24″.

It is desirable for the perfect simultaneousness of action that there be a communicating passage as indicated at 32, between the risers 13 and 23, or elsewhere between the air portion of the two systems, so as to provide equality of air pressure on the air clappers 46 of the two dry pipe valves. Upon the opening of the dry pipe valves and the rush of liquid through the risers 13 and 23 a small quantity of liquid from each flows into the connection 32. The gas formed at the place of meeting prevents further mingling of the liquids there; and the maintenance of this gas separation may be aided by providing a medial chamber 32′ in which the gas is entrapped. With such a communicating passage, the connection to the air clapper chambers can be made from either riser and is here illustrated as a pipe 39 from riser 13 having branches 39′ leading to the chambers above the air clappers 46.

The invention can also be used with an accelerator 34 whose entrance pipe 35 is shown connected through branches 35′ with each branch 39′ of pipe 39 at a point between an air clapper chamber and a restriction 39″ in the branch. These restrictions are large enough to transmit a drop in pressure in the distribution systems to the accelerator to cause actuation of the latter, and small enough to delay in-flow thereafter through the pipe 39, while the effective pressure in the chambers above the air clappers is being reduced by quick transfer of their air through the branch lines 35′, the accelerator 34 and the pipe 36 into either of the intermediate chambers 49, from which, by way of the common chamber 47 and passages 48 by the plungers 50, the fluid quickly reaches, and balances the pressure on the air clappers 46 so that the weights can fall. Instead of providing restrictions 39″, the pipe 39 itself could be very small, much smaller than the pipe 35 and its connections with the air clapper chambers, so that upon operation of the accelerator the out-rush of air from the chambers through the accelerator would exceed the inflow through the smaller pipe 39. If preferred, the accelerator may discharge into atmosphere, since the resulting bleeding of the air chambers would promptly reduce their effective pressure below the forces exerted upon the air clappers by the weighted levers. Upon the tripping of the latter each passage around the plunger 50 is closed, for each plunger in moving draws with a plug collar 50′ which seals the openings 48 in the wall of its chamber 49 and thereby prevents leakage of either liquid into the connecting chamber and into contact with the other liquid.

Accelerator 34 herein shown may be considered to be of the type which is shown in my Letters Patent of the United States No. 1,502,042 of July 22, 1924. The construction of this is such that all slow changes of pressure in the system 13 are disseminated without producing any action; but a rapid fall of pressure produces a reaction in the accelerator which connects passage 35 with 36 for discharge. If the apparatus is so arranged that this discharge goes into the atmosphere, it merely relieves the pressure on the top of auxiliary clappers 46. If it goes into the chamber 49, as illustrated, it hastens valve action somewhat by applying pressure to the under side of clappers 46. In neither event does the arrangement and type of accelerator illustrated appreciably affect pressure in the air distribution system 13, yet both dry pipe valves become tripped while the pressure in 13 and 23 remains still relatively high.

I claim as my invention:

1. In a dry pipe system for plural liquids, the combination with a dry pipe valve for

each liquid, having a weighted lever arranged to maintain said valve closed while suspended and adapted to open said valve upon being tripped, of means connecting said levers whereby the tripping of one effects simultaneous tripping of the other.

2. In a dry pipe system for plural liquids, the combination with a dry pipe valve for each liquid having a weighted lever arranged to maintain said valve closed while suspended and adapted to open said valve upon being tripped, of a link connecting one lever with the other whereby upon tripping of either lever the other is simultaneously tripped.

3. In a dry pipe system for plural liquids the combination with a distributing system for each liquid, having a dry pipe valve adapted to be held closed by pressure of its distributing system acting upon an auxiliary clapper and through linkage upon the liquid clapper of said valve, of means providing fluid connection between the undersides of said auxiliary clappers of both systems whereby the fluid pressure tending to open each auxiliary clapper is maintained the same.

4. In a dry pipe system for plural liquids comprising a distributing system for each liquid and a dry pipe valve therefor adapted to be held closed by pressure of the distributing system, acting upon an auxiliary clapper and through linkage upon the liquid clapper of said valve, the combination with means providing a fluid connection between the under sides of said auxiliary clappers, of an accelerator connected to one of the distributing systems for its own actuation and having a discharge connected to said means for actuation of said auxiliary clappers.

5. In a dry pipe system for plural liquids, the combination with a dry pipe valve for each liquid, having a weighted lever arranged to maintain said valve closed while supported and adapted to open said valve upon being tripped, of means connecting said levers whereby the tripping of one releases connection of the other to its support.

6. In a dry pipe system for plural liquids, the combination with a dry pipe valve for each liquid, having a weighted lever arranged to maintain said valve closed while supported and adapted to open said valve upon being tripped, of means connecting said levers whereby the tripping of one lever moves a part on the other lever transversely to its direction of descent, until clear of its support, thereby effecting tripping of said other lever.

7. In a dry pipe system for plural liquids, the combination with a dry pipe valve for each liquid, having a weighted lever arranged to maintain said valve closed while supported and adapted to open said valve upon being tripped, of a link connecting said levers arranged so that upon one lever being tripped its movement begins in a direction substantially perpendicular to the line of connection through said link and is thereafter constrained away from said initial direction to apply the force of momentum through the link to trip said other lever.

8. In a dry pipe system for plural liquids, the combination with a dry pipe valve for each liquid, having a weighted lever arranged to maintain said valve closed while supported and adapted to open said valve upon being tripped, of a link connecting said levers and arranged with respect to them so that as one lever swings about its fulcrum as a crank, said link acts as a connecting rod to pull said other lever from its support.

9. In a dry pipe system for plural liquids, having a separate distributing system and dry pipe valve for each liquid, the combination of two control systems of linkage, one for each valve, arranged to maintain said valves closed while suspended and adapted to open said valves upon being tripped, and means connecting said linkages whereby the tripping of one effects simultaneous tripping of the other.

10. In a dry pipe system for plural liquids, having a separate distributing system and dry pipe valve for each liquid, the combination of two control systems of linkage, one for each valve arranged to maintain said valves closed while suspended and adapted to open said valves upon being tripped; each said linkage system comprising a weighted lever, a hook latch link suspending it from a support and a cross link connecting the weighted lever of one system to the latch of the other system, the whole being arranged for the swing of either weighted lever to pull the latch of the other from its support.

11. In a dry pipe system for plural liquids the combination with a distributing system for each liquid, having a dry pipe valve adapted to be held closed by pressure of its distributing system acting upon an auxiliary clapper and through linkage upon the liquid clapper of said valve, of means providing fluid connection between the upper sides of said auxiliary clappers of both systems whereby the fluid pressure opposing opening of each auxiliary clapper is maintained the same.

12. In a dry pipe system for plural liquids, having a separate distributing system and dry pipe valve for each liquid, the combination of two control systems of linkage, one for each valve, arranged to maintain said valves closed while set and adapted to open said valves upon being tripped;

each said linkage system comprising a weighted lever, a hook latch link suspending it from a support and a cross link connecting the weighted lever of one system to the latch of the other system; the said cross link being arranged so that the fall of its weighted lever begins in a direction substantially at right angles to the longitudinal axis of said link, and thereafter alters in direction approaching parallelism with said axis, whereby the pull exerted on said link is gradually applied.

13. In a dry pipe system for plural liquids comprising a distributing system for each liquid and a dry pipe valve therefor adapted to be held closed by pressure of the distributing system, acting upon an auxiliary clapper and through linkage upon the liquid clapper of said valve, the combination with means providing a fluid connection between one of said distribution systems and the upper sides of said auxiliary clappers, of an accelerator connected with said connection whereby upon sudden drop of pressure in said distribution system, the pressure on said auxiliary clappers is discharged through the accelerator; the said connection being one which restricts in-flow from the distribution system.

14. In a dry pipe system for plural liquids comprising a distributing system for each liquid and a dry pipe valve therefor adapted to be held closed by pressure of the distributing system, acting upon an auxiliary clapper and through a linkage upon the liquid clapper of said valve, the combination with means providing a fluid connection between one of said distribution systems and the upper sides of said auxiliary clappers, of an accelerator connected with said connection whereby upon sudden drop of pressure in said distribution system, the pressure on said auxiliary clappers is discharged through the accelerator; said connection having between the distribution system and the connection with said accelerator a small opening for restricting in-flow from the distribution system to the auxiliary clappers.

15. In a dry pipe system for plural liquids, having a separate distributing system and dry pipe valve for each liquid, the combination of two control systems of linkage, one for each valve, adapted to maintain said valves closed while suspended and to open said valves upon being tripped, said linkage being arranged face to face, operating in opposed directions, and being interconnected, so that upon the tripping of one linkage the other linkage is simultaneously tripped.

Signed at Boston, Massachusetts, this 18th day of May, 1923.

ALBERT J. LOEPSINGER.