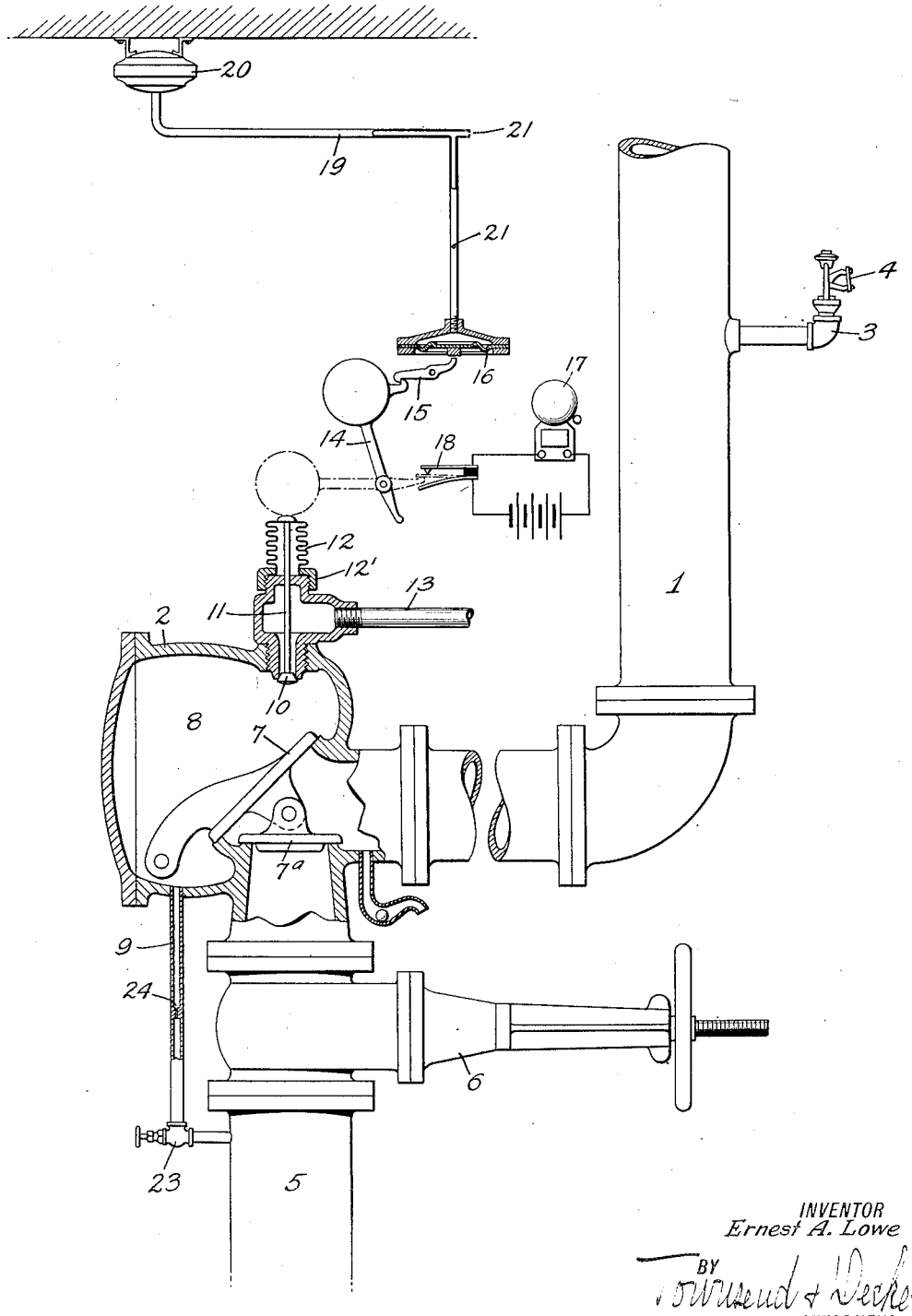
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AUTOMATIC FIRE EXTINGUISHING APPARATUS

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AUTOMATIC FIRE EXTINGUISHING APPARATUS

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This invention relates to fire extinguishing systems and more particularly to those wherein the system of distributing piping for the fire extinguishing fluid is provided, in the fire area or area to be protected, with sprinklers or other outlets for the fire extinguishing medium thermostatically controlled.

The general object of the invention is to eliminate the disadvantages and combine the advantages of the two systems known respectively as the wet-pipe system, in which the piping is filled with water, and the dry-pipe system in which the piping installed to protect the property is empty and filled with air. The wet-pipe system as usually installed is ordinarily regarded as superior in the respect that the water or other medium being always present at the sprinkler head or outlet is promptly delivered on the opening of said outlets when the fuse or other thermostatic or manual controlling means permits the same to open. Such system has the disadvantage that the water is liable to freeze in the distributing system unless protected by special means and that any accidental leak is liable to produce damage. In the dry-pipe system these disadvantages are partly eliminated in that the danger of freezing is avoided, since air not water is normally in the piping, but a leak may cause water damage since the escape of air through such a leak will cause the main valve to trip and water to issue through the leak. Said dry-pipe system is also subject to the objection that delay in the arrival of the fire extinguishing medium at the outlet after opening of the main valve occurs owing to the fact that the air must be displaced through the outlet before the water or other medium can arrive at said outlet. This is a disadvantage met with particularly in the usual dry-pipe system wherein an air pressure is maintained in the distributing piping for the purpose of holding back the water supply at the main valve by acting upon a supplemental clapper or disk through which the air pressure from the pipe is applied to hold the main valve closed against the influence of the water or other supply which tends to open the same. In said system the air, being confined under pressure in the piping, is caused to drop in pressure by the opening of the outlet consequent upon the fusing of the sprinkler head thus allowing air to escape and opening of the main valve ensues as a result of the drop of pressure.

Another disadvantage of the dry-pipe system referred to in which pressure is maintained is that it is necessary to provide means for maintaining the air pressure in said system by the operation of an air compressor or other device in order that the main valve may be kept closed.

Furthermore the opening of said main valve in the usual system only results from the initiation of actions following after the fusing of a sprinkler head and this contributes, owing to the slow action of the fuse in connection with the presence of air in the system, to delay in the arrival of water at the outlet.

One of the objects of the invention is to avoid delay in the arrival of the fire extinguishing fluid at the sprinkler head owing to the presence of air under pressure in said dry-pipe which is a feature of most dry-pipe systems and yet to permit the opening of the main valve to be controlled by an increase of air pressure produced by the heating of a body or column of air in the fire zone, said pressure being made effective at the main valve by suitable devices responding to variations of said air pressure.

In the preferred manner of carrying out the invention a supplemental air piping is provided to which are preferably connected heat absorbing air containers in the fire zone and at the location of the main valve pressure responsive devices are provided responsive to increase of pressure in said supplemental piping due to change of temperature and means controlled thereby for effecting the opening of the main valve by opening a supplemental valve through which a bypass pressure derived from the supply of extinguishing fluid normally holding said main valve closed may be relieved.

By using said supplemental air piping it becomes possible to employ an air thermostat in the fire zone which may be more sensitive or responsive in its action to changes of temperature than the usual fuse of the sprinkler head and thereby to secure an opening of the main valve in advance of the opening of the sprinkler head or outlet so that the water may be on its way to said outlet and ready to emerge as soon as the outlet is opened.

Furthermore by using air at normal or atmospheric pressure in said supplemental piping as well as in the main distributing piping the necessity of using compressors or other means for maintaining any form of energy in the system is dispensed with.

In carrying out this part of the invention a pressure responsive device like a diaphragm is used and a weighted arm or lever and trip therefor, together with a relief valve for the bypass pressure adapted to be engaged by the arm, thereby insuring positive opening of said bypass

pressure valve and the opening of the main valve when fire occurs in the protected area.

Another object of the invention is to provide means whereby an alarm may be given in advance of the opening of a sprinkler head and simultaneously if desired with the opening of the main valve due to the action of the air thermostat connected with the supplemental air piping.

A further object of the invention is to insure the operation of the bypass pressure relief valve and the sounding of the alarm therewith to which end there is used, in connection with the air pressure responsive device, a suitable weight released thereby, a valve adapted to be engaged by the weight when released to open the bypass relief valve and a circuit closer also engaged by the weighted arm or lever for the purpose of simultaneously giving a signal.

The accompanying drawing illustrates in elevation and partial section a portion of a fire extinguishing apparatus in which the invention is embodied in a preferable form. In said drawing the numeral 1 indicates the main pipe of the distributing portion of the system through which water or other fire extinguishing medium passes from the normally closed main valve 2. Connected with the main or standpipe 1 are the usual branch or other pipes provided with suitable outlets one of which, indicated at 3, is shown as comprising a sprinkler head of the usual form having a metallic fuse 4 which, on fusing, releases means for causing the sprinkler head outlet to open. 5 indicates the supply pipe leading from the source of fire extinguishing medium and 6 typifies any construction of gate valve cutting off the connection between 5 and 2.

The distributing piping holds air at normal or atmospheric pressure, no means being provided such for instance as a compressor or vacuum pump for maintaining plenum or vacuum therein. Any form or construction of outlet may be used in the different parts of the system although, as usual in the art, said outlets are ordinarily thermally controlled so that distribution of water or other medium may be confined in the particular thermally controlled outlet or outlets affected by fire.

In the preferred manner of carrying out the invention and as shown the outlets are normally closed and thermostatically controlled so that in case of premature, accidental or unauthorized opening of the main valve the fire extinguishing medium, usually water, will not pass through the thermally controlled outlets or sprinklers and thereby cause damage to the protected property. Furthermore the control of the main valve is by air operating by pressure due to acquired heat in the area to be protected and independently of any action of the thermostat and at the same time there is no necessity for using means to maintain the pressure of air or other agency either in the main distributing pipe or in the conductor provided for the agency whereby the main valve is controlled thus attaining all of the advantages of a dry-pipe system as well as others and eliminating the danger of damage by leakage of the fire extinguishing medium into the distributing piping.

In the main valve 2 a clapper 7*a* normally cuts off the supply of the medium from 5 to the system 1. Said valve is held to its seat by any desired means thermally controlled but in the preferred form of the invention a supplemental clapper or disk 7 connected to valve 7*a* is used and is normally subjected to the pressure of fluid in the chamber 8 communicating with the supply pipe 5 through a bypass of limited cross-section. The area on the back of the clapper or disk 7 subjected to the bypass pressure is much greater than the area of valve 7*a* which is subjected to pressure of the fluid in pipe 5 tending to open said valve. When the bypass pressure acting on 7 is relieved the valve 7*a* will open and admit fire extinguishing fluid from 5 into the pipe 1. The bypass which is preferably employed comprises a pipe or conduit 9 leading directly from a source of fluid pressure afforded by pipe 5 and entering the chamber 8 as shown.

Said pipe 9 may have a restricted section as indicated at 24 for positively limiting the flow therethrough when it is desired to have the valve 7*a* open through relief of pressure in 8 as will be presently described. A control valve 23 may be interposed in the connection from 5 through 9 to 8. It will be obvious that by closing the gate or other valve 6 pressure will be taken off valve 7*a*. The purpose of such arrangement is to permit quick and easy placing of the valve 7*a* and connecting members 7 in normal condition for automatic operation. By employing this arrangement of bypass in connection with a valve which cuts off the direct connection from 5 to the main valve 7*a* it is obvious that the action of re-setting the main valve after a normal operation thereof is facilitated since the pressure applied to valve 7 through bypass 9 when the shut-off valve 23 is opened is then not opposed by tendency of the pressure from 5 to displace the valve 7*a*. After re-setting, if desired, the control valve 23 can be closed in which case the relief of pressure in 8, by opening of a relief valve as will be presently described, will then become more quickly effective or said valve 23 may be left open and the operation effected by causing a discharge from the relief chamber to take place at a much greater rate than the flow into said chamber possible through the restricted bypass.

To relieve the bypass pressure in 8 and allow the valve 7*a* to become unseated, thereby supplying fire extinguishing fluid in the system, a suitable valve 10 is employed which valve has a stem 11 which, in the preferred form of the invention, extends up within and is attached to a collapsible and expansible hollow member 12 which may be of bellows-like construction and is secured around the valve stem 11 in a manner to form a watertight seal thereby dispensing with the use of a stuffing box and its attendant friction which would interfere with the free movement of the valve stem. The resiliency of the member 12 which may be of metal acts in a way to normally hold the valve 10 in its uppermost or closed position until it is forcibly depressed by extraneous means. Obviously any desired means acting like a spring might be employed for the purpose of holding the valve 10 closed. Upon the depression of the valve 10 to open the same the pressure in chamber 8 is allowed to escape through a suitable pipe 13 and the valve 7*a* thereupon opens by the pressure beneath it and admits the fluid from 5 to the system 1. To insure a quick operation the valve 10 and outlet or escape pipe 13 should be of such size as to allow the discharge to take place at a much greater rate than the inflow permissible through the restricted inlet or bypass 9.

The operation of the relief valve is preferably effected by the weighted arm or lever 14 normally held in lifted position by a trigger 15 adapted to be engaged and release the weight by

the action of some pressure responsive device like a diaphragm 16 which seals or closes an air chamber. Upon the release of the weight 14 through increase of pressure behind the diaphragm 16 the weight falls and, by engaging the relief valve, opens the same and permits the main valve to open as already explained. The result of this is that the liquid under pressure in the chamber 8 escapes freely therefrom through valve 10 and out at 13 and at a greater rate than can be compensated by the restricted supply through pipe 9 or bypass and as a consequence the main valve 7a opens under pressure of the medium supplied from the main 5.

There is indicated at 17 a suitable electric bell or signal the circuit of which is controlled by a circuit closer indicated at 18, the latter device being arranged to be engaged by an arm extending from the weighted arm 14 and to close the circuit and give an audible or other signal when the weighted arm is released and operates the relief valve.

At 19 is indicated a portion of the system of air piping extending from the zone or area to be protected against fire and terminating in a chamber behind the diaphragm 16. Said supplemental air piping 19 serves to convey air pressure, automatically produced by action of a thermostat in the zone or area to be protected, to the chamber wherein it may act on the diaphragm 16 or other device responsive to pressure. The pipe 19 covers the area or areas to be protected by the use of the corresponding sprinkler head or heads.

For the purpose of producing the increased air pressure and providing thermostatic action more sensitive than that of the sprinkler head thermostat and independently of any thermostatic action of the sprinkler head thermostat, containers or air bulbs 20, one of which is shown, have their interior connected with the tubing. Said bulb or container is for the purpose of providing a large heat absorptive surface or capacity to affect the volume of air in the container and connected tubing and the piping or its connections is provided also preferably with one or more of the compensating vents 21 of predetermined area or size, to determine the rate at which the temperature must rise to secure effective action by increase of pressure of the heated air upon the pressure responsive device 16. The air vent or inlet also permits the pressure in the supplemental system of air piping to be maintained at normal atmospheric pressure or, in other words, to equalize the pressure in the system of air tubing with that of the atmosphere, leaving the device however sensitive to changes of temperature at a rapid rate so great that the vent 21 would not prevent the accumulation of pressure that would operate on the diaphragm or other similar device 16.

In the case of the distributing piping 1 for the fluid extinguishing medium normal air pressure is maintained therein, provided it be normally closed at the fluid distributing outlets, by the usual automatic ball drip connected to the piping at or near the outlet or chamber into which the fluid from 5 passes on the opening of the valve 6.

As will be obvious no external or special means are required for maintaining an excess of pressure condition in the piping 1 or 19 in order that the system may function. The piping 19 and bulbs 20 provide a sensitive air thermostat more sensitive or responsive to heat conditions than the thermostat of the sprinkler head or similar outlet. In the case of incipient fires which quickly gather headway the air thermostat portion of the device will respond and not only open the relief valve but will give a signal thus permitting the use of hand extinguisher appliances or other means which will ordinarily be effective without an opening of the sprinkler head or outlet for the fire extinguishing medium supplied through piping 1. If the fire should continue the sprinkler head thermostat will be finally operated but owing to the previous action of the sensitive air thermostat the main valve will have been opened and the supply of water or other means will have arrived at the sprinkler head or outlet ready for delivery as soon as the thermostat fuses. In other words, on the occurrence of fire the main valve first operates, fills the system and rings an alarm in advance of the melting of the sprinkler head.

Should fire continue long enough to melt the sprinkler head, the pipes being full of water, the head will immediately discharge the same.

In many cases the water damage will be entirely eliminated as the interval of time between the alarm and melting of the head permits the first aid crew to function and extinguish the fire before the sprinkler head is opened. In no part of the system is it necessary to maintain an artificial pressure, either in the thermostatic or water distributing system of piping, while in the case of the main valve 2 the same is normally held effectually closed by the bypass or surface pressure supplied from pipe 5 until relieved by the action of the sensitive device or thermostat.

As will be seen, in this system, unlike typical dry-pipe operation, the operation of the improved valve is independent of the state of the air in the main piping which is at normal atmospheric pressure, but at the same time the supply of the fire extinguishing medium is at all times subject to the control of air pressure exerted through a supplemental system of piping which is in its turn normally maintained at normal atmospheric pressure but ready to carry an increase of pressure that would be effective in releasing the main valve on the occurrence of fire.

From the foregoing it will be apparent that this apparatus possesses the following advantages:

1. As the sprinkler system piping is normally at atmospheric pressure no air compressor or other maintenance apparatus is required to keep valve in normal or set position.

2. Damage to sprinkler head or piping does not operate valve and flood the premises when no fire exists.

3. The main valve only admits water to system piping from fire, or manual operation, thus saving possibility of accidental water damage.

4. Due to sensitive thermal action of air thermostat and release detent valve operates ahead of the melting of fusible metal sprinker head, fills piping with water and rings alarm. The supplemental air piping through which the main valve is operated does not require means for maintaining air pressure therein.

5. There is absence of danger from freezing since system pipes do not get water except in case of fire.

6. The apparatus is cheap to construct and no constant maintenance is necessary to keep system in operative condition.

7. Due to advance alarm and water filled pipes

ahead of sprinkler head opening less damage from fire or water may be expected.

What I claim as my invention is:

1. In a fire extinguishing apparatus, the combination with a system of dry piping having thermostatically controlled and normally closed outlets for the fire extinguishing medium in an area to be protected, a main valve controlling the admission of fire extinguishing medium to said piping and normally held closed by pressure of said medium supplied through a bypass around said main valve, a valve for relieving the bypass pressure provided through the bypass, pressure responsive means controlling the operation of said last named valve and an air thermostat responsive to relatively sudden temperature changes in the fire zone and connected with said pressure responsive means through independent piping and adjusted to cause operation of the relief valve in advance of the operation of the thermostatically controlled local outlet.

2. In a fire extinguishing system, the combination with a main distributing dry pipe containing air at normal atmospheric pressure and a valve normally cutting off admission of fire extinguishing medium thereto, means for normally holding said valve to its seat, releasing means for freeing the valve from the action of said holding means, a weighted actuating device normally detained in lifted position and adapted to engage and operate said releasing means when said weighted device is freed, normally closed sprinkler outlets connected with the main pipe and thermostatically controlled by means of fusible metallic controls, a supplemental pipe containing air at atmospheric pressure and extending from the area of fire protection in which said outlets are located to the actuating means for said valve, and pneumatically operated means for freeing said weight, said latter means being operated by a variation of air pressure in the supplemental pipe caused by a relatively sudden increase of temperature in the zone of fire protection.

3. In a dry-pipe fire extinguishing system or apparatus having a main distributing pipe containing air under normal atmospheric pressure and having a fuse-controlled sprinkler head, a main valve held to its seat by bypass pressure supplied around said valve, a valve for relieving the bypass pressure, a weighted actuated device normally detained in lifted position and adapted to engage and operate said valve when said weighted device is freed, supplemental air piping normally containing air at atmospheric pressure, means controlled by pre-determined variations of pressure in said supplemental piping for freeing said weighted actuated device and means for producing said predetermined variation of pressure in the supplemental piping on the occurrence of a relatively sudden increase of temperature in the area of fire protection in which the sprinkler head is located independent of and in advance of the action of the fuse.

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