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E. A. LOWE

2,187,906

THERMAL RELIEF VALVE

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Fig. 1.

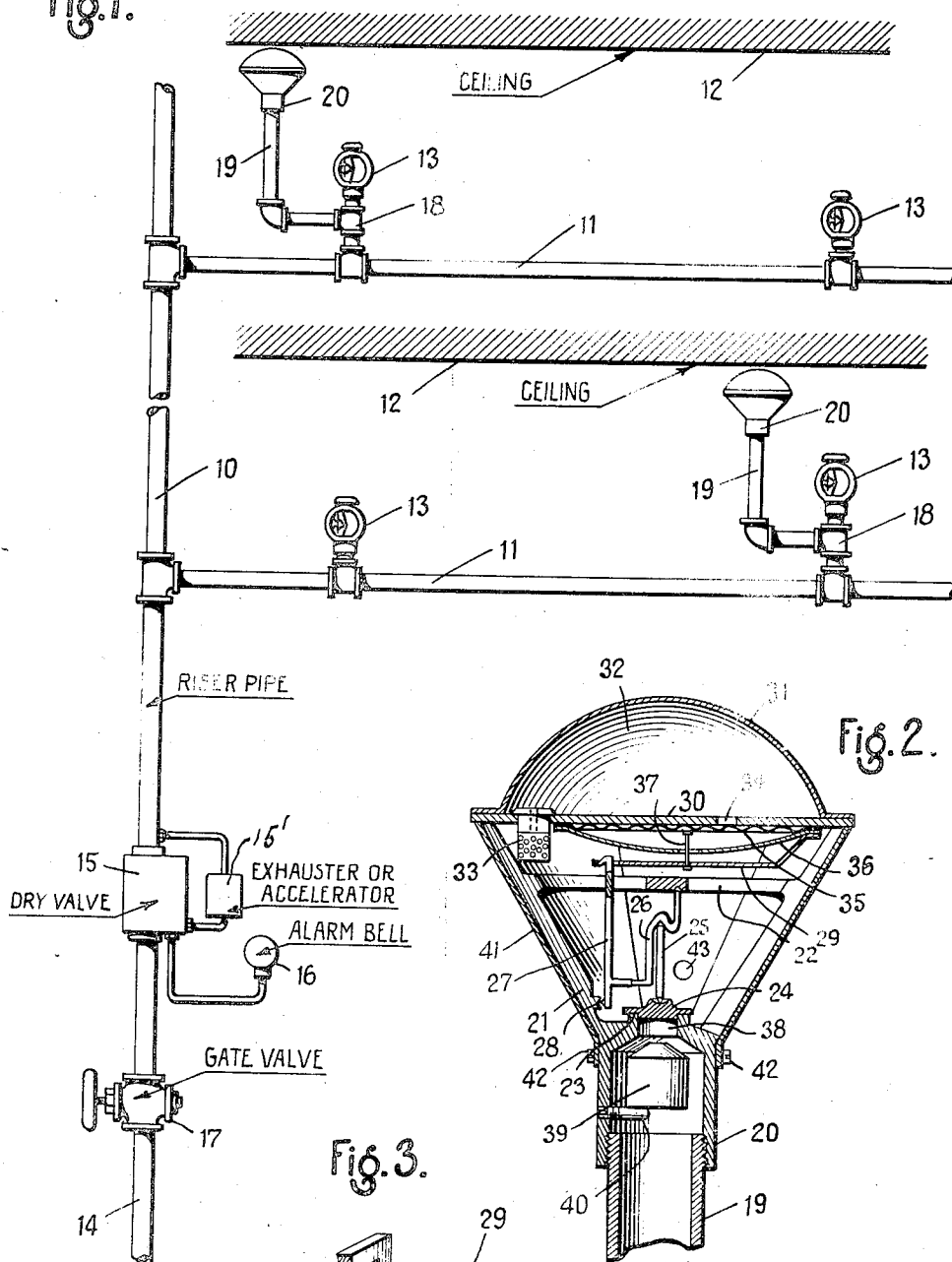


Fig. 2.

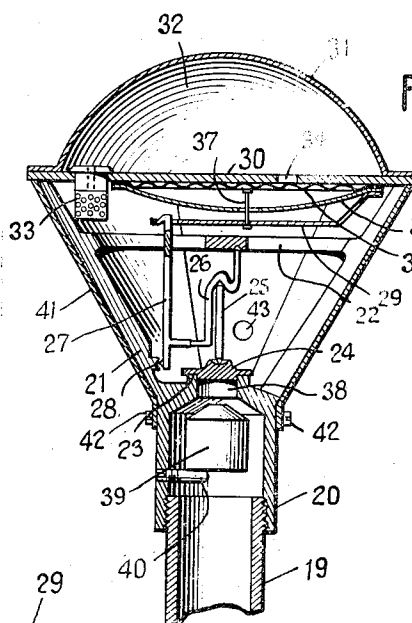
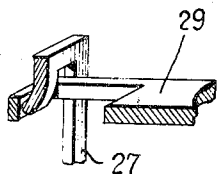


Fig. 3.



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UNITED STATES PATENT OFFICE

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THERMAL RELIEF VALVE

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Application June 12, 1936, Serial No. 84,816

9 Claims. (Cl. 169—17)

The present invention relates to fire extin-
guishing systems and more particularly to those
known in the art as dry pipe systems, and prefer-
ably, those wherein the supply of fire extinguish-
ing fluid is automatically controlled by means re-
sponsive to a substantial decrease in the normal
pressure in the system.

The fundamental principle of operation of the
dry pipe system is, as the title indicates, normally
to maintain an absence of water or other fire
extinguishing fluid from the several risers and
distributing pipes beyond an inlet valve placed,
with respect to a supply main, where there will
be no danger of freezing from such main to and
through such inlet valve. The piping of the sys-
tem beyond the valve is closed and may be main-
tained, as in the present case under air or other
pressure, and, in the event of fire, the heated air
resulting therefrom and enveloping the sprinkler
heads or outlets acts to open one or more sprinkler
outlets and release that pressure. With the elim-
ination of the air pressure in the piping, the pres-
sure on the inlet valve holding it closed is released
and it automatically opens and the fire extin-
guishing fluid, such as water, then immediately
flows into the normally dry portion of the system
and to the sprinkler outlet or outlets from which
it is discharged as customarily.

The limitations of dry pipe systems are too well
known in the trade to call for any extended ref-
erence at this time, but may be briefly summed
up as having limitations in the essentials deemed
necessary to all fire extinguishing systems, name-
ly, that of early detection of the fire, that of giv-
ing an advanced alarm of the existence of the fire,
and, in addition, that of the prompt conditioning
of the system for the delivery of the extinguish-
ing fluid to the sprinkler outlet or outlets which
have been opened by reason of the existence of
the fire.

Due to the inherent method of operation of
present day typical dry pipe systems, that is, the
method of conditioning the system and release of
the fire extinguishing fluid, the system remains
dormant until the fire has progressed to an extent
sufficient to generate a temperature at the
sprinkler head to place it in condition for ex-
tinguishing purposes. This generally is an indi-
cation that the fire has progressed to the stage of
violent conflagration. Then, even though the
sprinkler head has operated, the extinguishing
fluid is not immediately available for discharge
therefrom, and it is not available until the air is
first forced from the pipes intervening from the
inlet valve to the opened sprinkler outlet.

Where the sprinkler outlet is remote from the
inlet valve, a further delay results before dis-
charge of the extinguishing fluid which gives the
fire additional time to increase both in area and
intensity. In any event, an appreciable length of
time elapses between the start of the fire and
the discharge of the extinguishing fluid from the
sprinkler outlet in the typical dry pipe system,
due to the time necessary for the heat from the
fire to operate the sprinkler head and due to the
time necessary for expelling the air from the
piping necessary to trip the inlet valve and fur-
thermore due to the time necessary for the arrival
of the extinguishing fluid at the sprinkler head
or outlet after the inlet valve has tripped.

Recognition of these inherent operating defects
in a conventional dry pipe system is demonstrated
conclusively by the field fire record wherein, for
over thirty years, it has been shown that an av-
erage number of eleven sprinkler heads open in
the event of a fire where dry pipe systems have
been employed as compared with five heads in wet
pipe systems. As, manifestly, the object of any
fire extinguishing system is to extinguish the fire
as expeditiously as possible, the rapidity of response
of the extinguishing fluid to the fire itself de-
termines, in the last analysis, the protective value
of the system. Therefore, irrespective of the
number of outlets employed, the dry pipe system,
inherently subject to the lapse of time necessary
to deliver the extinguishing fluid to the fire re-
sulting in the consequent progress and intensi-
ty of the fire with resultant greater areas af-
fected before the control of the fire is initiated,
is regarded as a lesser protection and accord-
ingly less desirable than the wet pipe system which
is not so limited as has heretofore been explained.
However, in unheated properties, a wet system
having the limitation that the water therein
would freeze or be subjected to freezing tempera-
tures, dry systems must at the present time, of
necessity, be used, with the added disadvantage
that the insurance rates for properties so
equipped exceed that for properties when equipped
with a wet system as in heated properties. The
dry system is in very extensive use, particularly in
temperate climates where it constitutes a large
percentage of the total installations of fire ex-
tinguishing sprinkler systems.

Attempts have been made and methods have
been devised seeking to overcome, counteract or
obviate the disadvantages and limitations of the
dry pipe system and to improve the fire protec-
tion value thereof. Such attempts have usually
employed extensive auxiliary or supplemental ap-

paratus which have proved to be cumbersome and expensive and which so far have failed to meet with general acceptance by the trade. This failure of trade acceptance is believed to be due largely to the increased cost of special devices and of installation, especially in the case where a corrective to existing installations has been attempted, and due in part, at least, to the uncertainties involved both as to the mechanism and as to the human factor in setting, resetting, adjusting and otherwise maintaining the required auxiliary or supplemental apparatus found to be necessary to obtain the desired results.

A principal purpose of the present invention is to overcome the deficiencies of the prior-art dry-pipe systems and to render such systems more efficacious and more effective than even a wet pipe system of the present conventional type.

A further object of the invention is to provide a simple, inexpensive and dependable device that may be applied to any dry-pipe system without adversely changing the original system or interfering in any particular with its normal and originally intended operation and as required by the underwriter's approval and acceptance while at the same time possessing important additional and improved features and results.

Another object is to provide a simple device which will function when the temperature advances more rapidly than at a predetermined rate in order to condition the distributing pipes with water or fire-extinguishing fluid and in advance of the actual operation of the sprinkler head or heads and also to give an alarm during the conditioning of the pipes. Thus the invention contemplates virtual conversion of a dry pipe system into a wet pipe system and the sounding of an alarm during the period of heat production by a fire from its inception and before it reaches an intensity sufficient to operate a sprinkler outlet or outlets.

The invention looks to the provision of additional safety equipment in the dry pipe system which will tend to render better fire extinguishing performance and to decrease to an appreciable extent or obviate the present higher insurance charges for the employment of dry systems, in view of the prevention of damage to property from fire thus protected and the saving of water.

A still further object is to provide a thermal fire detector capable of improving the operation of and which may be applied both to old installations and to new installations of dry-pipe systems, and to provide a fire detector having a construction permitting it to be easily applied to dry-pipe systems at a cost within the economic commercial range.

A further object is to provide a device which, when once used, may be discarded, if desired, and replaced by a new one at small expense.

The invention consists in the novel thermal relief valve and in the combination of apparatus and details of construction and installation for effecting the above and other objects and will be described in connection with the accompanying drawing and then more particularly specified in the claims.

Referring to the accompanying drawing in which like numerals of reference indicate similar parts throughout the several views:

Figure 1 is a general lay-out of a dry-pipe system to which my invention has been applied;

Figure 2 is a vertical central sectional view of the safety or system-conditioning thermal device of the present invention; and

Figure 3 is a perspective sectional view showing the trip lock between a strut and the trip lever of the thermal device of Figure 2.

In the specific embodiment of the invention illustrated in the drawing, the system is designated generally as comprising a riser pipe 10 from which branch off a plurality of lateral distributing pipes 11 preferably in the area of the ceiling 12 of a room or other suitable enclosure. These distributing pipes 11 are equipped at intervals with sprinkler heads 13 which will automatically open under predetermined heat conditions caused by fire and which may be of the fusible link type if so desired. The system is filled with air under pressure, say 50 pounds, and when fire occurs, this air must be permitted to escape to be replaced by water flowing from a water main 14 and normally excluded from the system by an automatic dry valve 15 of a suitable construction, as, for instance, of the form and construction illustrated in detail in the patent to Hamilton, No. 1,763,777 dated June 17, 1930. In conjunction with said dry valve I prefer to employ an exhaustor or accelerator 15' for detecting the decrease in air pressure in the system occasioned by fire conditions and to quicken the discharge of the air from the system. An alarm 16, such as the bell indicated, is associated with the dry valve to give a definite indication of the filling of the system with water or other fire extinguishing fluid. It will of course be understood that the dry valve and exhaustor are positioned or situated in a heated room of the property, where it is not subjected to a freezing temperature, but therebeyond the system may be located in unheated portions of the property. A suitable hand valve 17 is also provided in the main 14 in advance of the dry valve 15 to enable the water to be shut off after the fire is extinguished and until the system is drained and the dry valve re-set. A conventional form of air compressor preferably is also employed but is not illustrated.

As in previous constructions, the dry valve 15 requires a very definite lowering of the air pressure in the system before said valve will operate, and as in the method of operation of typical dry pipe systems a sprinkler head would have to operate and open and permit a sustained escape of air from the system before the dry valve opens automatically. The present invention acts to open the dry valve in advance of the operation of the sprinkler-head, avoids the delays incident to the operation thereof and permits early replacement of the air in the system by water, so that when the sprinkler head finally operates there will be water immediately available at the sprinkler head to instantly be discharged therefrom. As here shown, the sprinkler heads 13 are extended upwardly toward the ceiling by interpositioning of a T-connection 18 between them and the distributing pipes 11. Then by other suitable pipe connections 19 the device forming a part of the invention is positioned immediately below the ceiling by preference and in communication with the system whereby, before actuation, it is subjected to the action of the air pressure in the system.

As shown more particularly in Figure 2, the relief valve forming a part of the present invention comprises a body portion 20, the lower end of which is screw-threaded to cooperate with a screw-threaded upper end of the pipe connection 19. The top of said body portion 20 includes a spider frame 21 diverging upwardly therefrom and having one or more braces 22 connecting and

supporting one or more of the spider arms 21. The body portion 20 is also provided with a closure seat 23 which is normally closed by a disc closure or cap 24. Said closure 24 is held on its seat 23 by a strut 25 extending upwardly and held in position by a toggle strut 26, the upper end of which is supported by one of the braces 22, and the lower flanged end of which is supported by a third strut 27, the lower end of which engages by a needle point engagement, as at 28, with a lug on one of the spider arms 21. The upper end of strut 27 engages the end of a horizontally disposed trip-lever 29 by a trip lock engagement.

Secured at the upper end of spider frame 21 is a stop plate 30 and secured to said plate is a dome 31 forming with said plate an air chamber 32. The air chamber 32 is closed with the exception of a breather air vent 33 and an aperture or opening 34. A movable diaphragm 35 is positioned and held in any desirable manner between the stop plate 30 and a lower stop plate 36 and is adapted for actuation when the air in air chamber 32 becomes heated at an abnormal rate and in consequence expands and is forced through the opening 34 in the stop plate 30 and against said diaphragm. This will occur upon any rapid or abnormal rate of rise of temperature in the vicinity of the dome 31, and such as would be occasioned by a fire, the increase of air pressure within the air chamber 32 then becoming so great as to be beyond the relief capacity of the vent 33, in which case it must escape through the opening 34 and thereupon actuate the diaphragm as just stated.

A pin 37 projects downwardly through a suitable opening, preferably centrally located, in the lower stop plate 36 and into operative engagement with the horizontally disposed trip-lever 29. As will be manifest, when a sudden expansion of air in the air chamber 32 occurs, the air is forced through the opening 34 in the upper stop plate 30 and against the diaphragm 35 whereupon, by reason of the presence of the pin 37, the trip-lever 29 is forced downwardly to release its trip lock engagement with the strut 27 with a consequent release of the several struts heretofore described resulting in a release of pressure against the cap 24 whereupon the pressure of the air in the system will automatically remove or force the cap 24 from its seat 23. In other words, the movement of the diaphragm occasioned by an abnormal increase in temperature in the area of the air chamber 32 causes the strut structure connecting the trip-lever 29 and the cap 24 to completely collapse, thereby releasing and permitting the cap 23 to move from its seat. Upon the displacement of said cap the air pressure in the system is released and the dry valve 15 then is automatically actuated to admit water upwardly through the riser 10 and through the distributing pipes 11 so that it is immediately available to be discharged from the sprinkler head adjacent the specific device affected when that sprinkler head is opened.

It is not desired or intended that the extinguishing fluid, such as water, shall be released to the room through the opening 38 in the closure seat 23 when the seat 23 is uncovered by the cap 24 to thereby cause possible unnecessary water damage. Accordingly, within the body portion and beneath the said opening 28 is a float valve 39 held adjacent the opening by suitable means such as the underlying pin 40 illustrated. When the extinguishing fluid reaches the float 39, it will lift said float, force it against the

downwardly directed seat adjacent the opening 38 and thus automatically prevent escape of the extinguishing fluid through said opening without first having prevented the escape of the air pressure in the system or the pre-filling of the system with water.

The spider frame 21 may, if so desired, be provided with a dust-protecting cover indicated at 41 which is normally held in position by the screws 42 and which may be slid downwardly on the body portion 20, in an obvious manner, to permit examination or cleaning or adjustment of the struts or other interior mechanism of the device. This cover provides an air admission and intermediate chamber for the reception of the strut mechanism and adjacent parts previously described and it may be provided with a plurality of openings or holes 43 for the escape of air from the system before the initiation of its operation. It is further intended that the entire device after use may be unscrewed from pipe connection 19, and discarded and replaced by a new one should it be so desired.

It will be apparent that the system may operate by the action of the sprinkler head as originally intended for the installation as in the event my device should, for any reason, fail to condition the system with the fire extinguishing fluid upon the outbreak of a fire, the system retains nevertheless all of its original and necessary operating features. The addition of my thermal device is auxiliary to the normal and conventional operation of the system, and will be affected and function by any abnormal rate of rise of temperature thus conditioning the system independently of and in advance of the operation of the sprinkler head in the fire area. As a result, there is provided an alarm before the sprinkler head operates and the dry system is therefore converted simultaneously into a wet system. It is especially to be noted that, if the alarm is responded to promptly, the fire may be otherwise controlled than by the opening of the sprinkler head thus effecting a saving of a large amount of fire extinguishing fluid and obviating a possible considerable and serious loss from damage by fire. However, if the alarm is disregarded, or the fire reaches an intensity causing the sprinkler head to operate, it may then be expected that no more than five heads per fire will be open as compared with eleven heads for which the dry pipe system is rated and so classed by the Underwriters in protection rating schedules.

It should be appreciated that in all typical dry or wet sprinkler systems, an alarm is never sounded until the fire has progressed to sufficient intensity to operate the sprinkler head in the system, in contradistinction to the system of the present invention in which an alarm is given before the sprinkler head operates, or indeed, if it ever operates. This certainty of early alarm affording valuable minutes for fire-fighting which are lost in the typical or conventional present dry and wet system is an important attribute permitting successful fire prevention and control.

The invention claimed is:

1. A dry-pipe system having a riser and a distributing pipe connected thereto and both normally free from fire-extinguishing fluid but subjected to air pressure, a main control valve for controlling the supply of fire-extinguishing fluid to said riser and distributing pipe and held in closed position by said air pressure, a closed fixed

temperature operated sprinkler head connected to said distributing pipe, and a rate of rise thermal device normally under balance of normal atmospheric pressure and connected to the sprinkler head and having a valve normally closing communication between the distributing pipe and the atmosphere and including a member controlling said valve and acting on an abnormal rate of rise of temperature to open said valve and thereby release the pressure upon and trip said main control valve and permit the flow of fire-extinguishing fluid to said riser and distributing pipe prior to the attainment of a temperature sufficient to open said sprinkler head.

2. A dry-pipe system having a riser and a distributing pipe connected thereto and both normally free from fire-extinguishing fluid but subjected to air pressure, a main control valve for controlling the supply of fire-extinguishing fluid to said riser and distributing pipe and held in closed position by said air pressure, a closed fixed temperature operated sprinkler head connected to said distributing pipe, a rate of rise thermal device normally under balance of normal atmospheric pressure and connected to the sprinkler head and having a valve normally closing communication between the distributing pipe and the atmosphere and including a member controlling said valve and acting on an abnormal rate of rise of temperature to open said valve and thereby release the pressure upon and trip said main control valve and permit the flow of fire-extinguishing fluid through said riser and distributing pipe prior to the attainment of a temperature sufficient to open said sprinkler head, and means associated with the said thermal device for preventing the flow of fire-extinguishing fluid through said thermal device after said thermal device has been actuated.

3. A dry-pipe system having a riser and a distributing pipe connected thereto and both normally free from fire-extinguishing fluid but subjected to air pressure, a main control valve for controlling the supply of fire-extinguishing fluid to said riser and distributing pipe and held in closed position by said air pressure, a closed thermally-operated sprinkler head connected to said distributing pipe, a rate of rise thermal device normally under balance of normal atmospheric pressure and connected to the sprinkler head and having a valve normally closing communication between the distributing pipe and the atmosphere and including a member controlling said valve and acting on an abnormal rate of rise of temperature to open said valve and thereby release the air pressure upon and trip said main control valve and permit the flow of fire-extinguishing fluid through said riser and distributing pipe prior to the opening of said sprinkler head, means in the connection between said sprinkler head and said thermal device for preventing the flow of fire-extinguishing fluid through said thermal device, and an alarm associated with said main control valve adapted to be actuated upon the tripping thereof by the release of air pressure thereagainst.

4. A thermal device acting on the principle of an abnormal rate of temperature rise for connection to a dry-pipe fire-extinguishing system normally free from fire-extinguishing fluid but subjected to air pressure and employing one or more closed sprinkler heads comprising an inlet pipe, a valve seat at an end thereof, a releasable cap normally closing said valve seat, a thermal chamber disposed in spaced relationship to said

inlet pipe and valve seat and separated from the intervening space by a partition wall, said chamber having a breather air vent and said wall having an opening therein, a movable diaphragm in intimate association with said wall and responsive to air flowing through said opening, a lever in said space, a connection between said diaphragm and said lever and detachable means connecting said lever and said cap.

5. A thermal device acting on the principle of an abnormal rate of temperature rise for connection to a dry-pipe fire-extinguishing system normally free from fire-extinguishing fluid but subjected to air pressure and employing one or more closed sprinkler heads comprising an inlet pipe, a valve seat thereon, a releasable cap normally closing said valve seat and resisting the pressure of air in the system, an intermediate chamber connected to said inlet pipe a thermal chamber surmounting said intermediate chamber and separated therefrom by an intervening wall, said intermediate chamber and inlet pipe being normally closed from each other by said cap and said thermal chamber having an air vent and said wall having an opening therein communicating with the thermal chamber, a movable diaphragm in intimate association with said wall and responsive to expanded air flowing from said thermal chamber and through said opening, a lever in the intermediate chamber, a connection between said diaphragm and said lever, and collapsible connecting devices connecting said lever and said cap and normally holding said cap on said valve seat but adapted to be collapsed upon movement of said diaphragm to thereby permit said cap to be automatically unseated from said valve seat by the action of the air pressure in the system.

6. A thermal device acting on the principle of an abnormal rate of temperature rise for connection to a dry-pipe fire-extinguishing system normally free from fire-extinguishing fluid but subjected to air pressure and employing one or more closed sprinkler heads comprising an inlet pipe terminating on its upper end in a valve seat and having an opening extending therethrough, a releasable cap normally seated on and closing the opening in said valve seat, an intermediate chamber connected to said inlet pipe, a thermal chamber, a wall separating said chambers, said thermal chamber having a breather air vent and said wall having an air opening therein communicating with said thermal chamber, a movable diaphragm positioned on the opposite side of the wall from the thermal chamber and so as to be actuated by the expanded air flowing from said chamber, a lever, and a collapsible connection comprising a series of struts connecting said lever and cap and adapted to be collapsed to unseat said cap from its seat by the action of the air pressure in the system and upon movement of said diaphragm.

7. A thermal device acting on the principle of an abnormal rate of temperature rise for connection to a dry-pipe fire-extinguishing system normally free from fire-extinguishing fluid but subjected to air pressure and employing one or more closed sprinkler heads, comprising an inlet pipe provided with a valve seat having an opening extending therethrough, a releasable cap normally seated on and closing the opening in said valve seat, a spider frame connected to said inlet pipe, a thermal chamber connected to said spider frame and having an air vent and an air opening in a wall thereof, a movable diaphragm

positioned beneath said opening, a trip lever connected to said spider frame, a connection between said trip lever and said diaphragm, a series of struts connecting said lever and cap and adapted to be collapsed to unseat said cap from said valve seat by the action of the air pressure in the system and upon movement of said diaphragm, a float valve for closing the opening in said valve seat to prevent flow of the extinguishing medium therethrough and means within said inlet pipe for normally supporting said float valve.

8. A dry-pipe sprinkler system embodying a water supply pipe, a distributing pipe, a fixed temperature operated sprinkler head connected with the distributing pipe, a main control valve controlling the flow of water from the supply pipe to the distributing pipe, said valve being normally held closed by air pressure in the distributing pipe, and a device controlling the release of air from the distributing pipe to relieve the valve from air pressure and to permit said valve to open, said device comprising an air admission chamber connected to the distributing pipe and in normal communication with the atmosphere, a vent valve normally closing communication between said chamber and the distributing pipe, a thermal chamber having a breather air vent and separated from said air admission chamber by a partition wall having an opening therein, a diaphragm exposed to the flow of air through said opening produced by an

abnormal rate of rise of temperature in the thermal chamber, and means controlled by the diaphragm for opening the vent valve.

9. A dry-pipe sprinkler system embodying a water supply pipe, a distributing pipe, a fixed temperature operated sprinkler head connected with the distributing pipe, a main control valve controlling the flow of water from the supply pipe to the distributing pipe, said main control valve being normally held closed by air pressure in the distributing pipe, and a device controlling the release of air from the distributing pipe to relieve the valve from air pressure and to permit said valve to open, said device comprising an air admission chamber connected to the distributing pipe and in normal communication with the atmosphere, a vent valve normally closing communication between said chamber and the distributing pipe, a thermal chamber having a breather air vent and separated from said air admission chamber by a partition wall having an opening therein, a diaphragm exposed to the flow of air through said opening produced by an abnormal rate of rise of temperature in the thermal chamber, means controlled by the diaphragm for opening the vent valve, and a float valve for closing communication between the distributing pipe and air admission chamber under water pressure when the vent valve is opened.

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