

Nov. 23, 1943.

E. A. LOWE

2,334,826

FIRE EXTINGUISHING APPARATUS

Filed Oct. 4, 1940

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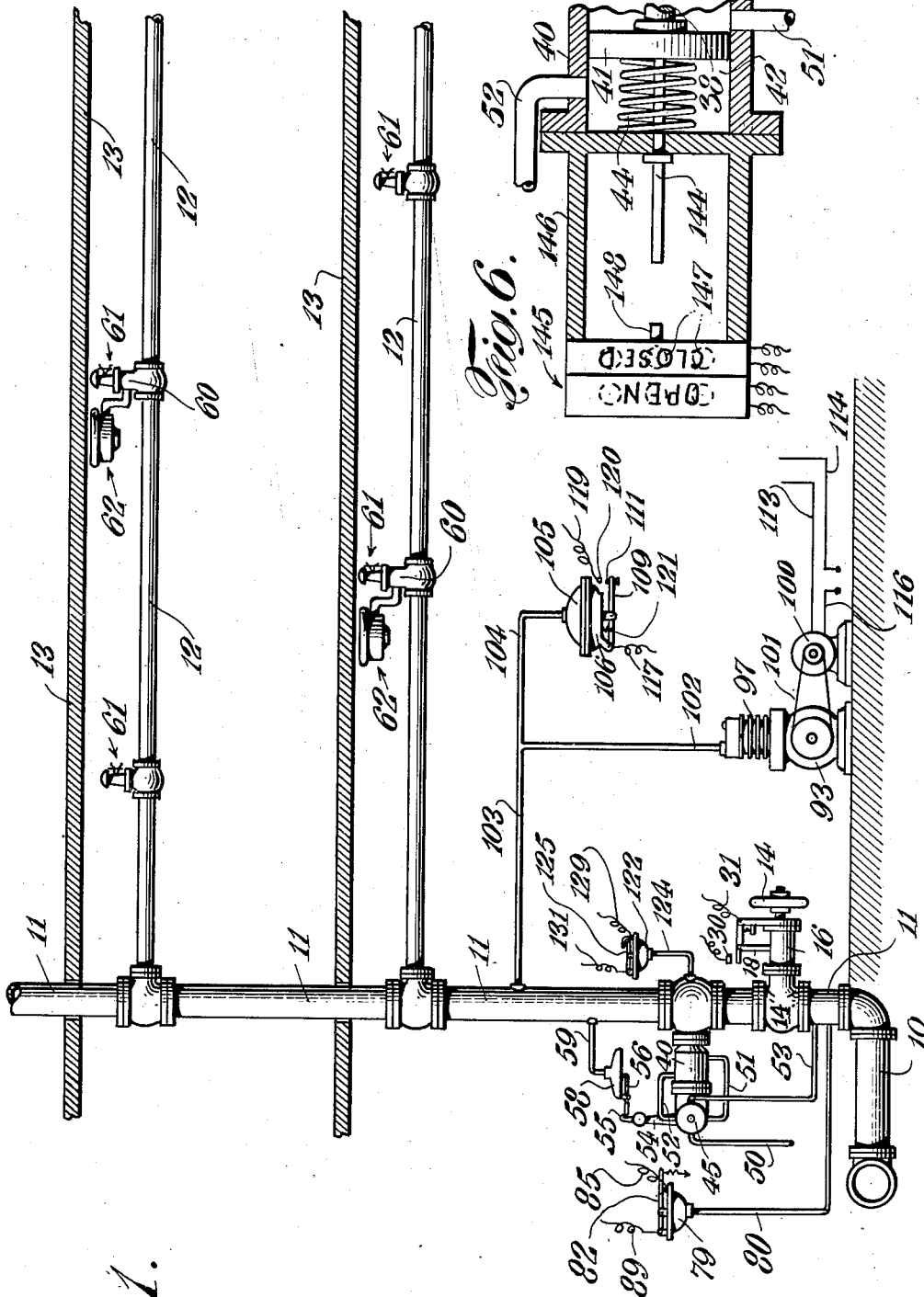


Fig. 1.

Fig. 6.

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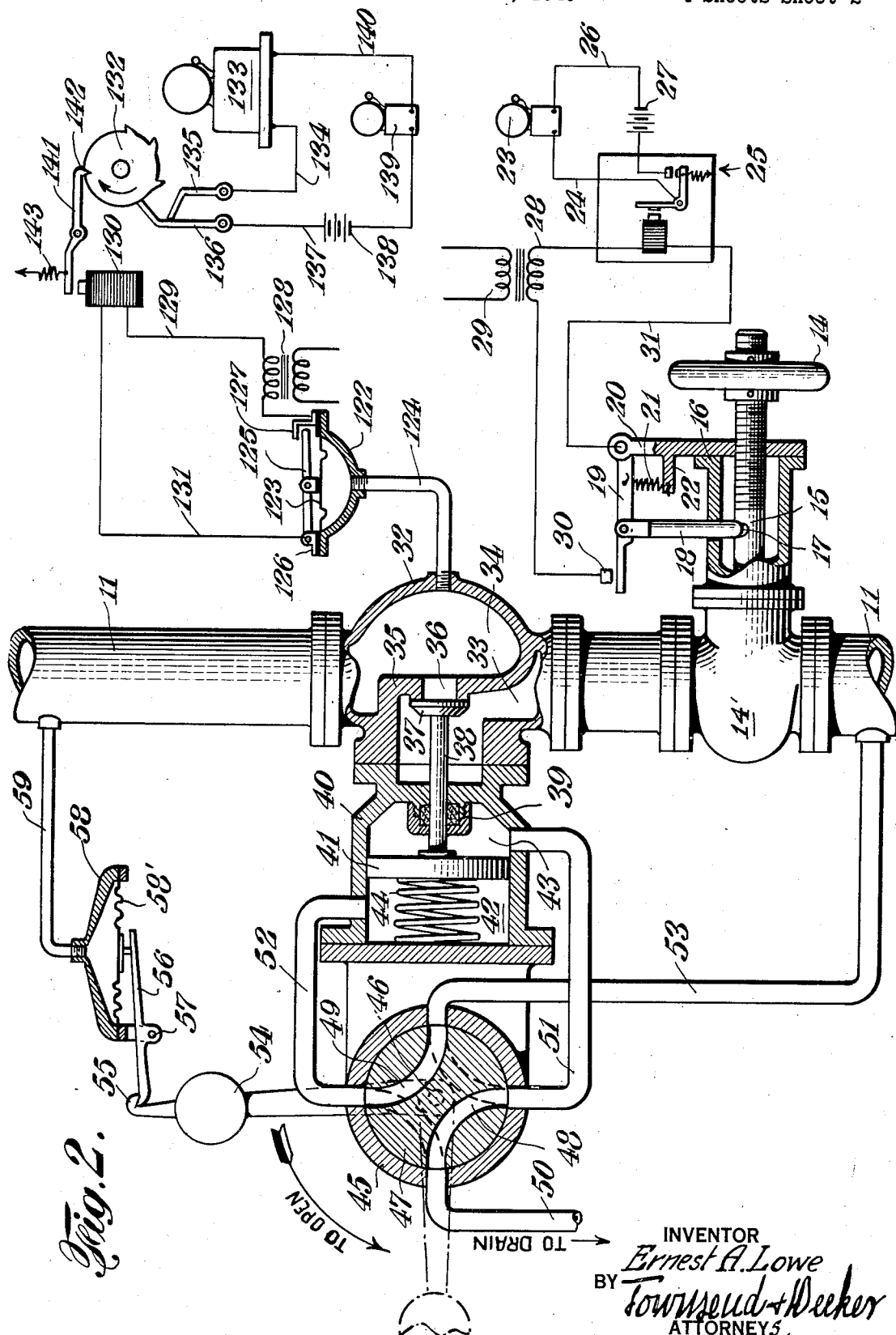
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4 Sheets-Sheet 3

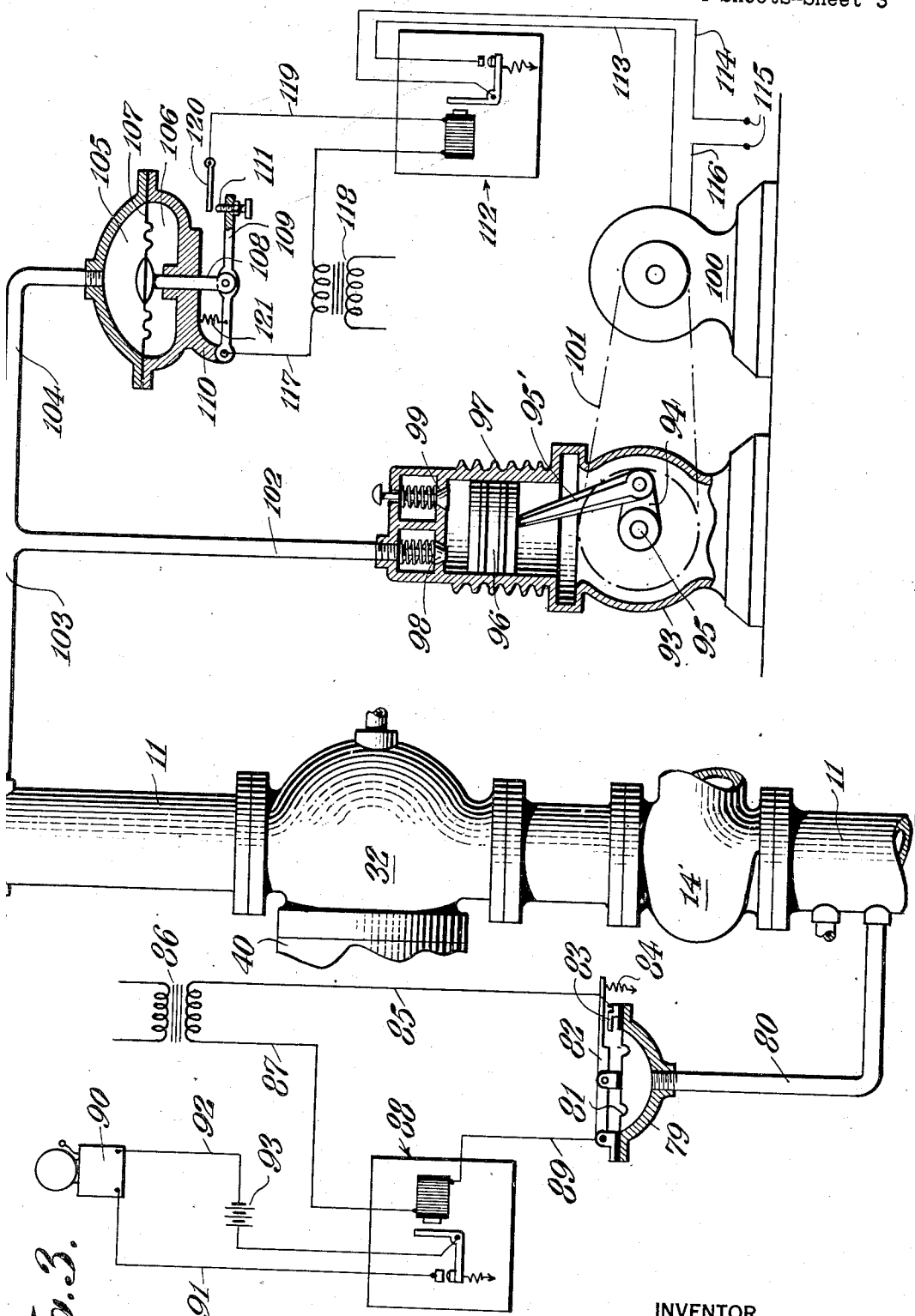


Fig. 3.

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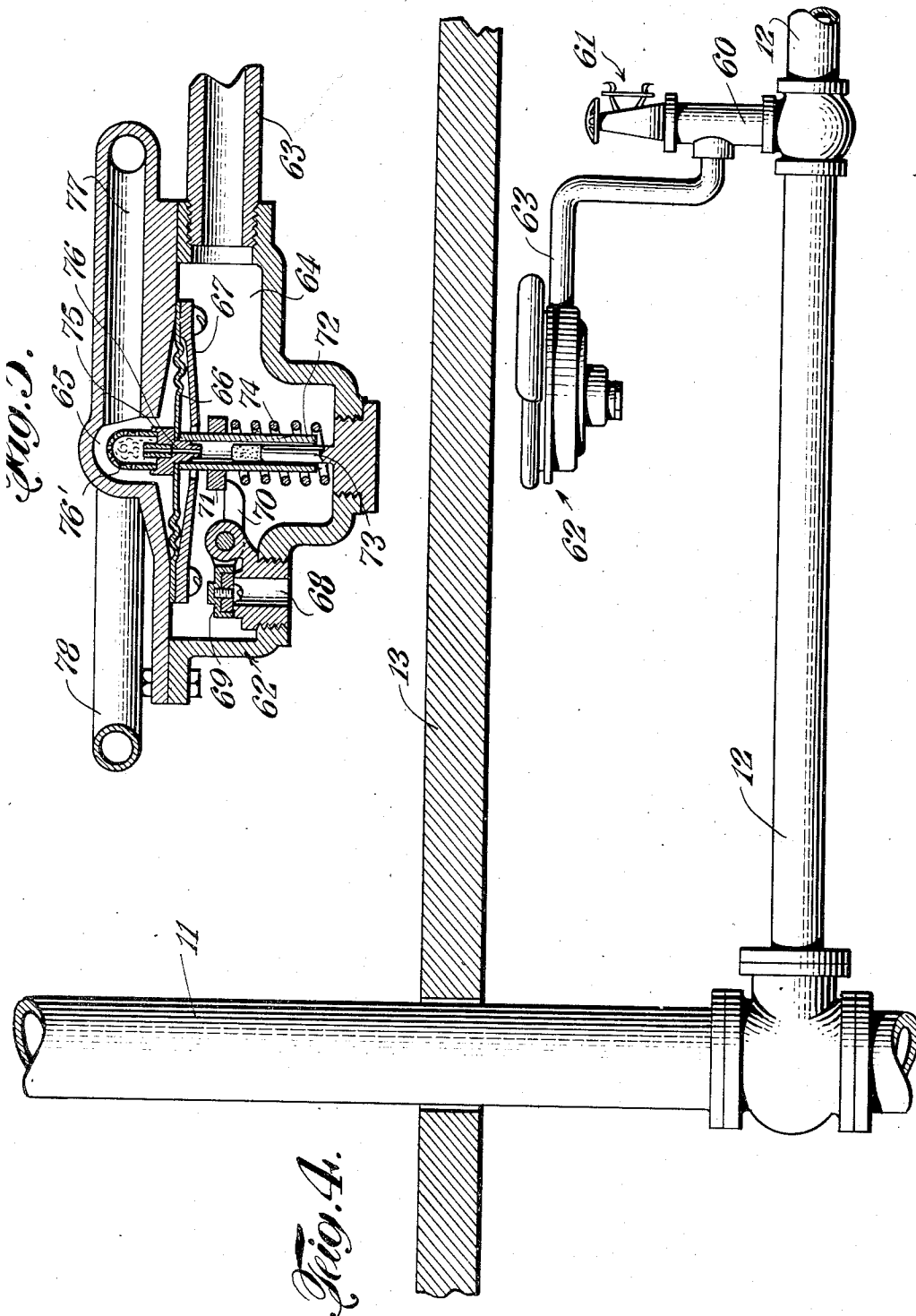
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4 Sheets-Sheet 4



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FIRE EXTINGUISHING APPARATUS

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Application October 4, 1940, Serial No. 359,750

23 Claims. (Cl. 169-17)

The present invention has been made after many years of careful study of the art of fire controlling and extinguishing systems and apparatus and has for its principal object the combining in one system and for universal use a simplified and inexpensive system utilizing a combination of such improved parts and features which have, from years of tests and use, proven to be the best ones available to secure the results aimed at. In constructing and assembling the apparatus of the invention I preferably not only employ standard parts and pipes and fittings of the combined systems at present on the market and easily obtainable but I eliminate to a great extent the many adverse limitations now prevalent in each such separate standard system.

A further object of the present invention is the production of a fire detecting and extinguishing system of a simple combination of parts and complete in all details, the same system being suitable for use in either heated or unheated properties, and without change of the type of system, thus obviating the need of two different types, with its attendant commercial waste.

Another object of the invention is the production of a system of the above character described having improved dependability and method of detection of fires by the employment of two separate and distinct types of fire detecting devices on the system, each able to operate independently of the other and with one more sensitive to the action of heat than the other, thus in reality giving in the one system two different methods of fire detection and system operation, with one more expeditious of operation than the other and with both recognized as standard and each independent of the other for emergency action.

At the present time, because of necessity and of varying or different conditions, two separate and distinct types of fire extinguishing systems are employed to wit: those known as the "dry pipe" and the "wet pipe" systems. Each type, however, has many limitations and the specific requirements of the purchaser and user must be carefully weighed before the installation of any specific type is employed. It has been attempted heretofore to combine in modified form both systems in one installation but such attempts have been an expensive procedure as the various apparatus, control features and method of operation are distinctly different in each of the systems and are not interchangeable or the same system usable in both heated or unheated properties or those properties which have unheated sections. The combining of the systems, further-

more, has made necessary the provision of a multiplicity of separate and auxiliary devices and parts resulting in a complicated, expensive and unwieldy structure susceptible to disarrangement and break-downs and, in many cases, to premature operation resulting in loss by property damage. Some of these modified systems are at present in use but are unsatisfactory for various reasons and have failed to present the real solution to the problem.

By means of the present system, which I designate a "Universal" system, I have provided a single type of system at no increase in cost which may be used in all occupancies, whether the premises are heated or unheated, instead of two different and distinct types which have been used for many years. The invention also permits of the ready renovation of either of the present types of systems without the necessity of any drastic changes therein or expensive additions thereto as the present Universal system does not require the installation of any separate or special auxiliary system.

Theoretically, as respects speed of operation, a wet pipe system is preferable. It, however, has disadvantages which a dry pipe system does not possess and vice versa. A wet pipe system, as the name implies, is one in which the system piping including the main riser and the distributing pipes on one or more floors of a building, and which are usually positioned adjacent the ceilings, are always filled with the extinguishing fluid, as water, so that it is available for immediate discharge and distribution by the sprinkler heads when they open under the influence of heat, as from the heat of a fire. This results in increased speed of operation and is the primary reason why wet pipe systems are preferred over dry pipe systems. In unheated buildings, however, such for instance, as in aeroplane hangars, or other buildings where heat is not required or desired, the use of a wet pipe system is not practicable for the reason that in cold weather the water in the pipes is susceptible to freezing thus making the apparatus inoperative and in addition making for liability to damage of property by water due to broken pipes. This system requires special types of control valves and other various parts not necessary and in fact unsuited for use in dry pipe systems.

On the other hand, the standard dry pipe systems, which may be used in unheated properties, are those in which the main riser and distributing pipes are normally not filled with the extinguishing fluid but, in most instances, with

compressed air which usually is the medium for holding the main automatic control valve in closed position and which also prevents the admission of the extinguishing fluid to the system until the actual occurrence of a fire. Thus, before the system is able to function, the normally closed sprinkler head or heads must first fuse to open them and enable the piping to be freed of its compressed air, and thereby permit the main valve to open by pressure of the extinguishing medium, whereby the extinguishing medium will flow to the opened sprinkler head or heads for discharge therefrom. These steps consume valuable time in which much damage can be done by a fire, especially a fast-moving fire which might occur in a building in which highly inflammable materials are stored. In cases of this character, any loss of time before a fire is attacked, even seconds, can well result very seriously. The dry pipe systems also require special types of control valves and other various parts not necessary and in fact unsuited for use in wet pipe systems. Accordingly, it has heretofore not been possible to combine the apparatus, or some of it, of both systems into one simple and quick-operating system embodying the desirable features of each of them and having additional improved features to produce a more dependable system which shall be operable under all conditions.

In the present invention I have combined the best features of both systems just discussed and have associated therewith certain meritorious features not heretofore employed in either system. Furthermore, I have obtained by the use of the invention a number of advantages as heretofore mentioned and others which will be referred to briefly before making a detailed description of the apparatus and parts thereof and of the invention. Inasmuch as they are distinct advantages and advances in the art, they may be considered as objects of the invention.

In the present invention, although I employ the use of compressed air in the system as in present standard dry pipe systems, the pressure required in this particular case is but from 1½ to 2 lbs. per square inch maximum in contradistinction to present standard systems in which a pressure of approximately 45 lbs. per square inch is necessary. This comes about by reason of the fact that in present standard dry systems relatively high air pressure is necessary to hold the automatic main control valve closed against the fluctuations in the pressure of the extinguishing fluid from the source of supply which fluid pressure automatically opens the main valve to admit the extinguishing fluid to the system when the pressure of the compressed air therein has been relieved. In the present instance the compressed air does not, per se, hold the main control valve closed by direct pressure thereagainst but it does, nevertheless, affect certain instrumentalities which in turn affect the opening and closing of the main valve.

Because of the manner of operation of the main control valve in the present case, I eliminate the detrimental effects of water "surges" which occur periodically in systems in which water is supplied under pressure, for instance, from a city water main. These water surges heretofore have resulted in the improper functioning of dry pipe systems in that they have caused certain parts of the system to operate prematurely, thus filling the pipes with water, causing possible damage by freezing and water damage and the giving of a fire signal, thereby

necessitating time-consuming adjustments of parts, the resetting of some of them and repairs or replacements if the system freezes. It has been attempted to eliminate the giving of an alarm by such "surges" in certain cases by providing what are known as alarm "retard" devices to retard the operation of certain parts when such periodic surges occur. The inclusion of such devices, of necessity, introduces limitations in the system and increases its cost of installation and are not necessary in the present construction. In the instant case the opening and closing of the main control valve is effected by the pressure of the extinguishing fluid thereagainst or against a supplemental movable part connected to the main valve, even though that pressure may vary, and the presence of water surges does not adversely affect the position of the main valve or the instantaneous functioning of the system and its parts in proper sequence and at the proper time.

In furtherance of the general objects of the invention and in particular I provide a relief device for relieving the system from the pressure of compressed air therein to promptly condition the system with extinguishing fluid upon the occurrence of a fire whereupon the system will operate more quickly from the effect of an incipient fire, separate actuating means independent of the aforesaid relief device for detecting fires and for also relieving the system of the pressure of compressed air, novel means for automatically actuating the main control valve upon a variation in the amount of such air pressure, means for automatically boosting or increasing the air pressure when it has fallen below a predetermined amount, the giving of a signal in that event and the automatic stopping of such boosting means and signal when the amount of the desired air pressure in the system again has been attained. I further provide for the giving of a signal should there be a failure of the main supply of extinguishing fluid under pressure, or an appreciable drop in the amount of its pressure, the giving of a local as well as a general signal immediately upon the occurrence of a fire and in advance of the operation of the sprinkler head or heads, the giving of a signal should the main shut-off or gate valve controlling the flow of extinguishing fluid to the system be turned towards closing position either by design or from inadvertence and a visual indicator to indicate whether the main automatic control valve is in open or closed position.

In addition to the foregoing I have further provided a system of the general character above described which shall be responsive for its operation upon two well-known principles, that of the rate-of-rise of temperature or that on the attainment of a predetermined degree of temperature. I therefore increase the fire fighting qualities of the system to an appreciable degree.

A brief summary of many of the advantages of the invention are now catalogued possibly at the expense of some repetition but to emphasize the importance of the invention and are as follows:

A. The Universal system detects fire by the most efficacious method known, that of the rate-of-rise principle. This also is supplemented by a separate method, known as the fixed temperature principle, thereby utilizing two separate methods of fire detecting in the one system each operating independently of the other.

B. A fire alarm signal is given in advance of the opening of the sprinkler head to enable a

first-aid crew, when possible, to extinguish the fire before the sprinkler head opens and operates, thereby eliminating water damage which is now reported to be some 80% of the total damage from all fires.

C. The main automatic control valve is provided with a self-indicating feature showing at all times whether the valve is open or closed.

D. The system is not susceptible to the objectionable effects of water supply surges thereby obviating the giving of false alarms so prevalent in both present wet and dry systems.

E. The system gives a local fire signal at the location of the fire in addition to a signal general for all purposes.

F. Full automatic supervision features are inherent in the system and a warning alarm is sounded if trouble occurs. This relieves an attendant of much of his personal attention and vigilance heretofore found necessary and accordingly lowers the cost of maintenance.

G. The system may be purchased and installed at no greater cost to the public than the present wet and dry pipe systems.

H. The system employs accepted standard types of sprinkler apparatus, pipes and fittings that may be readily and cheaply obtained from a number of manufacturers of sprinkler systems and these various parts may be readily combined to produce the invention embodying one system for universal use in any and all properties instead of the two types, wet and dry above, referred to.

I. In the present system all pipes are empty and hence are not susceptible to freezing and one universal type of system only is provided suitable for both heated and unheated properties.

J. As the system is not susceptible to freezing, water damages and loss of protection from freeze-ups are eliminated.

K. Automatic notification is instantly given should the water supply to the system be either cut off or so reduced in pressure as to be inoperative.

L. Instant notification is given if the main hand control valve is tampered with, as for instance, an attempt to close the same.

M. The system employs extremely low air pressure ($1\frac{1}{2}$ to 2 lbs. per sq. inch) which is maintained as an automatic supervising medium for determining breaks in the piping or any loss in the operating requirements, a signal being given upon any derangement thereof.

Further objects and advantages of the improved system embodying the invention will become apparent from the sub-joined description thereof, the invention consisting in the novel parts and combinations thereof hereinafter more particularly described and then specified in the claims.

In the accompanying drawings illustrating a typical and preferred embodiment of the invention:

Fig. 1 is a side elevation of a portion of a general lay-out illustrating most of, but not all, of the elements making up the combination of the invention.

Fig. 2 is an enlarged side elevation (partly in section) of those parts lying adjacent the main control valve.

Fig. 3 is a side elevation (partly in section) of a portion of the details of the water supervisory device and alarm, the air compressor for main-

taining a constant pressure of air in the system and the automatic air pressure switch.

Fig. 4 is an elevation of a portion of the system showing one of the rate-of-rise air relief valves and one of the sprinkler heads.

Fig. 5 is a section taken through one of the rate-of-rise air relief valves, and

Fig. 6 is an elevation of an indicator adapted for attachment to the automatic main control valve for determining by visual inspection whether said valve is in open or closed position.

Referring in detail to the several figures of the drawings:

The reference numeral 10 indicates a pipe from which the fire extinguishing fluid is obtained from a source of supply as from a city water main supplying water under pressure. This pipe connects with a suitable riser 11 from which horizontal branch or distributing pipes 12 extend preferably adjacent the ceiling of a room or other enclosure. The operating wheel of a conventional manually controlled gate valve 14' for controlling the flow of water from its source to the riser 11 is indicated at 14 and it is provided with a shank 15 threading through a wall of a supporting cylindrical housing 16, said shank connecting with said gate valve 14' to open or close it by manipulation of the operating wheel 14. The shank 15 is grooved, as at 17. The groove receives the end of a rod 18 extending through an opening in a wall of the housing 16 and which slidably supports the rod. The upper end of the rod 18 is pivoted, as shown, to a contact lever 19 which in turn is pivoted to an extension 20 on a wall of supporting housing 16. A tension spring 21 secured to said lever 19 and to a lug 22 on said wall normally urges the end of the rod 18 into engagement with the groove 17 and when in this position the gate valve is open thus permitting the extinguishing fluid to flow into the riser 11.

When the gate valve is closed, of course, the system becomes inoperative for fire control and extinguishing purposes because of the failure of the flow of the extinguishing fluid thereto. To guard against a situation of this character, either from design or inadvertence, I have provided for the sounding of an alarm in the form of a bell 23 which connects by conductor 24 to gate valve trouble relay, indicated generally at 25, and by conductor 26, through battery 27 to said relay. The relay in turn is connected by conductor 28 through transformer 29 to contact 30 and by conductor 31 to extension 20 on supporting housing 16. Thus, when the wheel 14 is manipulated to close the gate valve the end of rod 18 rides out of groove 17 on shank 15 and onto the outer peripheral surface of said shank to force the end of lever 19 to move upwardly and engage contact 30 thereby closing the circuit and energizing bell 23. When the wheel 14 is again rotated in the proper direction to open the gate valve, the end of rod 18 engages within groove 17 and releases lever 19 from engagement with contact 30 to break the circuit and deenergize bell 23.

The main automatic control valve housing which is incorporated within the riser 11 is indicated at 32. Within it the water or other extinguishing fluid chambers 33 and 34 respectively are provided separated by a wall 35 apertured, as at 36, and providing a seat for the main valve 37 all as more clearly shown in Fig. 2. To condition or fill the system, the extinguishing fluid flows or is forced upwardly through the gate valve,

through riser 11, into chamber 33, through aperture or opening 36, into chamber 34, thence into the upper portion of riser 11 and to and through the distributing pipes 12. The valve 37 is provided with a valve stem 38 extending rearwardly through a stuffing box 39 and into a cylindrical closed housing 40 in which a piston head 41 constituting a valve actuator may be slidably reciprocated and to which the inner end of the valve stem 38 is connected. The piston head separates the housing 40 into two liquid chambers to wit: 42 and 43 respectively neither of which communicates directly with the fluid chamber 33. As illustrated, chamber 42 is provided with a coiled compression spring 44 which, by its action, acts to retain the valve 37 on its seat to close the valve opening 36 against the passage of liquid there-through. Inasmuch as the piston head 41 and the main control valve 37 are rigidly connected together by the valve stem 38 and neither is movable independently of the other, together they constitute a single element for all practical purposes.

A four-way valve is indicated at 45. If so desired it may be secured to the housing 40 in any desirable manner. Mounted within the valve on a central shaft 46 is a rotatable valve member 47 provided with extinguishing fluid passageways 48 and 49 respectively. Normally, that is, when the main valve 37 is closed and in seated position to close the passageway 36, one end of fluid passageway 48 registers with the upper end of drain pipe 50 which extends within the wall of valve 45 while the other end registers with a pipe 51, one end of which extends within the wall of valve 45 while the other end communicates with liquid chamber 43 of cylindrical housing 40. When the parts are in this position, as more fully shown in full lines in Fig. 2, one end of fluid passageway 49 registers with the end of a pipe 52 which extends through the wall of valve 45, its other end communicating with liquid chamber 42 of housing 40, while the other end of passageway 49 registers with an end of pipe 53 extending through the valve 45, its lower end being connected to the lower part of the riser 11 beneath the gate valve previously described.

The lower end of a weighted lever 54 is secured to shaft 46 to rotate therewith. The upper end of said lever 54 is normally hooked in upper and retracted position by latch 55 of an arm 56 pivoted to an extension 57 of an air chamber 58 a wall of which comprises a flexible diaphragm 58' to which the inner end of arm 56 is fastened in any desirable manner. A pipe 59 connects air chamber 58 with the riser 11 at a point remote from the location of main control valve 37.

Mounted on suitable spaced connections 60 on the branch or distributing pipes 12 are closed fusible sprinkler heads indicated generally at 61, the construction of which is very old in the art and requires no detailed description. Suffice it to say they are provided with elements which fuse under the influence of heat of a predetermined degree, as that occasioned by a fire, to open the heads, condition the system with the extinguishing fluid and permit discharge of the extinguishing fluid from the system for fire controlling and extinguishing purposes.

I prefer to have the system filled with compressed air as hereinbefore referred to for purposes to be hereinafter described but the pressure of that compressed air for the purpose for which it is provided need only be small and approximately from 1½ lbs. to 2 lbs. per square inch.

Obviously, however, the compressed air must be expelled from the system in a predetermined amount before the extinguishing fluid can enter it to be discharged from the sprinkler heads for fire controlling and extinguishing purposes. To expel the air, I first provide a quick-acting relief valve acting on the rate-of-rise of temperature principle and depending for its action on the rate of change of temperature rather than on the attainment of a fixed degree of temperature sufficient, for instance, to fuse and thus open the sprinkler heads. Accordingly, when a fire occurs, the sudden rise in temperature occasioned thereby automatically actuates the relief valve to permit the escape of compressed air from the system and to actuate the other parts and open the main valve whereby water or other extinguishing fluid will condition or fill the system ready for immediate discharge from the sprinkler heads when they fuse and open. Should the relief valve, for any reason, operate imperfectly, or fail to operate at all, the compressed air will escape from the system and the same results will be accomplished upon the fusing and opening of the sprinkler head or heads, as will be manifest.

A relief valve of the character just referred to and which might be employed is indicated at 62 (Figs. 4 and 5) and is shown and described in the patent to W. B. Griffith, No. 1,909,490, dated May 16, 1933. The relief valve per se is preferably connected to one or more of the pipes 60 for the fusible sprinkler heads 61 by a pipe 63 whereby it is under the influence of the compressed air in the system.

As described in the aforesaid patent, a pressure chamber 64 is provided as well as a chamber 65 communicating with the pressure chamber but which is separated from chamber 64 by a flexible diaphragm 66 supported in any desirable manner as by plate 67. An exhaust port is indicated at 68 and is normally closed by a valve 69 which is connected to a pivoted lever 70 the inner end of which engages beneath a collar 71 secured upon a tube 72. Said tube is loosely supported by a guide post 73 and the tube extends through the plate 67 and is fastened to the diaphragm 66. A coiled spring 74 encircles the lower part of tube 72 and supports its weight and the weight of the associated parts.

The upper end of tube 72 is provided with a plug or head 75 extending within chamber 65 and having a passageway 76 therein restricted in size at its upper end. This provides an equalizing vent for equalizing the air pressure in pressure chamber 64 and chamber 65. A perforated shield 76' surmounts the upper end of plug 75 if so desired. A pipe connection 77 is provided between chamber 65 and a coil or tube 78 constituting the rate-of-rise element which is formed of relatively thin metal having a large surface area exposed to the outer atmosphere. Upon a sudden rise in temperature, as from the heat generated by a fire, the air in element 78 quickly and appreciably expands and its pressure flexes diaphragm 66 downwardly against the action of spring 74 thereby exerting pressure against the inner end of pivoted lever 70 by collar 71 to rock the lever on its pivot and disengage valve 69 from its seat. This opens exhaust port 68 and permits the escape of compressed air from the system through the port after which valve 69 automatically closes to close said port in an obvious manner.

While I have shown and described a construction of relief valve operable on the rate-of-rise principle and adapted upon functioning to permit

the escape of compressed air from the system whereby the system may be conditioned or filled with the extinguishing fluid prior to the fusing of a sprinkler head or heads, it will be noted that the valve so shown and described is normally under the influence of the compressed air in the system. This may be found objectionable in some cases and in those cases I propose the use of relief valves in which the relief element thereof is at no time in direct communication with the system piping. Examples of such valves will be found in my prior Patents Nos. 2,187,906, dated January 23, 1940, and 2,213,528, dated September 3, 1940. A fusing and opening of the sprinkler head or heads will accomplish the same result, however, as in the previous case.

If the supply of water from the main should fail, or if its pressure should be insufficient for fire controlling and extinguishing purposes, it is desirable that an attendant or others should immediately be apprised of those facts. Accordingly, I have provided a signal for that purpose. Referring to Fig. 3, 79 indicates a pressure chamber connected by pipe 80 to the lower portion of the riser and beneath the gate valve. The upper wall of chamber 79 may constitute a flexible diaphragm 81 to which a lever 82 is attached and which is pivoted to an extension on a wall of the chamber 79. An electrical contact 83 may be carried by the opposite side of the chamber and the pressure of the water flowing through pipe 80 flexes the diaphragm upwardly against the action of a spring 84 and prevents the engagement of the end of the lever with the contact 83. The contact is connected by conductor 85 with a transformer 86 which in turn is connected with the coil of a relay by conductor 87, said relay being designated generally as 88. Said coil is also connected by conductor 89 with lever 82.

A bell or other desired signal is indicated at 90. It is electrically connected by conductors 91 and 92 with the proper parts of relay 88, conductor 92 being interconnected with battery 93. When there is no water pressure in pipe 80 or when the pressure therein falls appreciably, diaphragm 81 retracts and the action of spring 84 draws the end of lever 82 into engagement with contact 83. This closes the circuit and energizes signal 90 which continues to sound an alarm until the pressure in pipe 80 has been restored to again expand diaphragm 81 and release lever 82 from its engagement with contact 83 in an obvious manner.

For the proper functioning of the apparatus it is necessary that its piping system, at least so much of it as is positioned above the main control valve 37, be filled with compressed air when the system is not operating, although the pressure thereof need only be relatively small and perhaps but from 1½ lbs. to 2 lbs. per square inch as hereinbefore explained. Nevertheless, this constant pressure must be maintained. To compensate for possible loss in pressure because of leaks, etc., I have provided an automatic air compressor and automatic air pressure switch and regulator in the system, the construction of which will not be explained. This air compressor operates instantaneously upon a drop of air pressure in the system to prevent any premature opening of the main automatic control valve in the manner hereinafter explained. It cannot, however, supply air pressure to the system faster than the compressed air will escape therefrom should the relief valve hereinbefore explained be actuated and opened or should a sprinkler head fuse and

open to permit the system to become conditioned with the extinguishing fluid and to permit the system to function upon the opening of a sprinkler head.

Referring particularly to Fig. 3, the body of the air compressor pump is indicated at 93 and is provided with crank arm 94 mounted on shaft 95, the crank arm being connected by means of connecting rod 95' to a piston head 96 reciprocable in cylinder 97. The head of the cylinder is provided with a spring-controlled air outlet poppet valve 98 and a spring-controlled air inlet valve 99. The air compressor pump is driven by a motor here shown conventionally and indicated at 100, the belt connection between the pump and motor being designated as 101. A compressed air outlet pipe is shown at 102 and communicates with the air outlet poppet valve 98. Obviously, on the down-stroke of the piston head 96, air is drawn into the cylinder 97 by suction while on its up-stroke the air so drawn in is compressed and forced through the poppet valve 98 into pipe 102. The pipe is provided with two branches 103 and 104 respectively, the first of which connects with riser 11, while the second connects with the upper chamber 105 of an automatic air pressure switch and regulator, the lower chamber of which is indicated at 106. The chambers are separated by a flexible diaphragm 107 to which a rod 108 is attached. Said rod slidably extends through the lower wall of chamber 106 and is pivotally connected to a bar 109, one end of which is pivoted to an extension 110 of the lower wall of chamber 106, while the other end carries a contact 111 in the form of a set-screw.

A relay is indicated generally at 112. Conductors 113 and 114 are connected to the proper parts of said relay and also to motor 100 and a source of current supply 115 respectively. A conductor 116 also connects the motor and the source of current supply. The bar 109 is also electrically connected by conductor 117 with a transformer 118 which is in turn connected to the coil of relay 112. A still further conductor 119 connects said coil and a contact 120 which lies adjacent contact 111. A tension spring 121 is provided and is fastened to the bar 109 and lower wall of chamber 106. Its action tends to force the rod 108 upwardly and in consequence the diaphragm 107 in the same direction against the pressure of the compressed air.

When the piping of the system is filled with compressed air of the required amount, pressure is exerted thereby against the upper side of diaphragm 107 and holds the bar 109 in the position shown and against the action of spring 121 with the contacts 111 and 120 out of engagement with each other. When the pressure falls below the required predetermined amount, however, which can be adjusted by the position of contact set-screw 111, the spring 121 acts through bar 109 and rod 108 to press the diaphragm 107 upwardly against whatever air pressure remains in chamber 105 thereby bringing contacts 111 and 120 into engagement to energize the relay 112 and start the motor 100. The air compressor is then brought into operation in the manner heretofore explained. When the pressure has again reached the degree required, it again forces the diaphragm downwardly, against the action of spring 121, a sufficient distance to disengage contacts 111 and 120 to break the circuit whereupon the operation of motor 100 and the air compressor pump 93 will cease. The operations are all en-

tirely automatic and they will repeat themselves whenever and as often as is necessary.

It is desirable that a signal be given both in the vicinity of the location of the fire and at a central station immediately upon the opening of the main control valve and in advance of the opening of a sprinkler head or heads. Accordingly, this has been provided for in the present system. Referring particularly to Fig. 2, a fluid pressure chamber is indicated at 122 and its upper wall preferably comprises a flexible diaphragm 123 fastened to the chamber in any desired manner. Said chamber is connected by pipe 124 to chamber 34. A bar 125 is fastened to diaphragm 123 and an end thereof is pivoted to an extension 126 on a wall of chamber 122. On the opposite side a contact 127 is mounted.

Contact 127 is electrically connected to a transformer 128 which in turn is connected by conductor 129 to electromagnet 130. The electromagnet is connected by conductor 131 to bar 125. A clock is indicated at 132 and is adapted, when released, to send code or other signals to a trouble register 133 usually located in a central station. The register is connected by conductor 134 to pivoted contact 135 which engages pivoted contact 136. The end of pivoted contact 136 engages the peripheral toothed edge of the clock 132 to give the desired interrupted code signals by intermittently breaking the contact between contacts 135 and 136 when the clock is in operation. Contact 136 is also connected by conductor 137 to a battery 138 which in turn is connected to a local signal which, in this case, is in the form of a bell 139. Conductor 140 electrically connects bell 139 and register 133 together.

To hold the clock 132 against rotation, I provide a pivoted lever 141 having a hooked end 142 normally engaging within a notch in the clock and held in this position by the action of a spring 143. When the main control valve 37 is unseated, the extinguishing fluid flows through opening 36 into chamber 34 and then by way of pipe 124 into fluid pressure chamber 122 where it exerts pressure, upwardly directed, against diaphragm 123 thereby causing bar 125 to engage contact 127 to close the electrical circuit and energize electromagnet 130. This rocks lever 141 on its pivot in a counterclockwise direction and against the action of spring 143 to release the hooked end 142 from its engagement with the notch in clock 132 which rotates the clock and brings register 133 and alarm 139 into operation.

When fire breaks out the relief valve previously described is almost immediately affected by the sudden rate-of-rise of temperature occasioned thereby and in advance of the fusing and opening of a sprinkler head. This results in the release of the compressed air in the system in the manner previously described and faster than it can be restored by the air compressor thereby relieving the diaphragm 58' of the air pressure which had been present in air chamber 58. Should the relief valve fail to function properly, or to function at all, the same result is accomplished by the fusing and opening of a sprinkler head.

The release of pressure on the diaphragm 58' causes it to move or be deflected or contracted inwardly thereby swiveling the arm 56 on its pivot and disengaging the latch or hook 55 from the end of weighted lever 54. Lever 54 then falls by gravity in the direction of the arrow (Fig. 2) to rotate the valve member 47 with it. The ends

of valve passageway 48 will then be brought into register with pipes 51 and 53 respectively and the ends of valve passageway 49 into register with pipes 52 and 50, as shown in dotted lines. Obviously, therefore, the water under pressure from the source of supply will then flow through pipe 53, passageway 48 and pipe 51 into chamber 43 and any water in chamber 42 will flow or be forced through pipe 52, passageway 49 and to and through the drain pipe 50. The reversal of pressure to the opposite side of piston head 41 forces it rearwardly against the action of spring 44 to unseat the main control valve 37 and force the extinguishing fluid through the opening 36 and up and through the riser and distributing pipe to thoroughly condition the system and send an alarm and permit of the immediate discharge of the extinguishing fluid from the sprinkler heads as soon as they fuse and open.

From the above explanation, it will be understood that the position of the valve member 47 determines the position of the main control valve, that is, whether it is in open or closed position. Said valve member 47, manifestly, controls the flow of the extinguishing fluid either to chamber 43 or to chamber 42. When the extinguishing fluid flows into chamber 42, pressure is exerted against the back of the piston head 41 to hold the main control valve in closed position, or that position shown in Fig. 2. When however, the valve member 47 is swung to open position or in the direction indicated by the arrow in Fig. 2, flow of the extinguishing medium to chamber 42 is cut-off and is diverted to chamber 43 and it exerts pressure against the reverse face of piston head 41 to force the main control valve into open position as will be apparent.

Although the main control valve is at all times subjected to the pressure of extinguishing fluid flowing from the source of supply, this fact does not prevent the opening of the main control valve when the flow of the fluid is diverted to the opposite side of the piston head 41 and into chamber 43 because of the pressure differential between the piston head 41 and main control valve 37 brought about by the greatly increased surface area of the former over the latter.

To determine by mere visual inspection whether the main control valve is in open or closed position I have provided a convenient indicator illustrated in Fig. 6. When this indicator is employed, the valve 45 and associated parts are positioned further to the left or more remote from the cylindrical housing 40 than as shown in Fig. 2. In said Fig. 6 the reference numeral 144 indicates a rod which is fastened to the piston head 41 and which extends through the rear wall of the housing 40. The casing 145 bearing the legends "closed" and "open" is supported by bracket member 146 and a pair of lamps 147 is housed within said casing behind said legends. The electrical circuits for said lamps 147 are so arranged that when the parts are in the position shown in Fig. 6, the lamp behind the legend "closed" will be energized and when the rod 144 engages with a contact member 148, because of the movement of the main control valve to open position, the lamp behind the word "open" will be energized.

The invention claimed is:

1. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a main riser connected thereto, distributing pipes connected to said main riser, said riser and distributing pipes normally being filled with

air under pressure other than atmospheric pressure, a main control valve for controlling the supply of extinguishing fluid to the riser and distributing pipes and operable to closed or open position by the pressure of said extinguishing fluid and held in closed position by such pressure, normally closed fusible sprinkler heads mounted on said distributing pipes, an air relief device connected to one of said sprinkler heads and automatically operable upon an abnormal rate of rise in temperature to permit equalization of the pressure of air in the system with that of the atmosphere and to thereby condition the system with extinguishing fluid prior to the opening of a sprinkler head, an air pressure-responsive device connected to the system and responsive to a variation of air pressure therein and means connecting said pressure-responsive device and the main control valve for reversing the direction of the pressure of the extinguishing fluid against the main control valve to automatically open the same and operable upon actuation of said air pressure-responsive device.

2. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in communication therewith and normally under the influence of air under pressure in excess of atmospheric pressure, normally closed fusible sprinkler heads adapted for opening under the influence of a predetermined degree of heat, a main control valve adapted to control the admission of said fluid to the system, means carried by said system for automatically permitting the escape of excess air pressure from said pipes upon an abnormal rate-of-rise in temperature to condition the system with extinguishing fluid prior to the opening of a sprinkler head, air pressure-responsive means connected to the system and operable upon a variation in the amount of pressure therein, a supplemental control element connected to said main control valve and under pressure of the extinguishing fluid for normally holding the main control valve in closed position and valve means connecting said pressure-responsive means and supplemental control element and automatically operable upon actuation of said escapement means to reverse the direction of pressure of the extinguishing fluid against the supplemental element and thereby force the main control valve into open position.

3. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in communication therewith and normally under the influence of air under pressure in excess of atmospheric pressure, normally closed fusible sprinkler heads mounted on the distributing pipes and adapted for opening under the influence of a predetermined degree of heat, a main control valve adapted to control the admission of said fluid to the system, means carried by said system for relieving said pipes from excess air pressure upon an abnormal rate-of-rise in temperature to thereby condition the system with extinguishing fluid prior to the opening of a sprinkler head, air pressure-responsive means connected to the distributing pipes and operable upon a variation of air pressure in said pipes, a supplemental control element connected to said main control valve and having opposed sides each of greater surface area than either side of said main control valve with one of the sides of said supplemental element normally under full pressure of the extinguishing fluid while the other side is free from pressure for

holding the main control valve in closed position and means connecting said pressure-responsive means and said supplemental control element and automatically operable upon actuation of said pressure relieving means to divert the pressure of the extinguishing fluid from one side of said supplemental element to the opposed side thereof and to relieve said one side from any pressure and thereby force the main control valve into open position.

4. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in communication therewith and normally under the influence of air under pressure in excess of atmospheric pressure, normally closed fusible sprinkler heads mounted on the distributing pipes and adapted for opening under the influence of a predetermined degree of heat, a main control valve adapted to control the admission of said fluid to the system, means carried by said system for relieving said pipes from excess air pressure upon an abnormal rate-of-rise in temperature to thereby condition the system with extinguishing fluid prior to the opening of a sprinkler head, air pressure-responsive means connected to the distributing pipes and operable upon a variation of air pressure in said pipes, a supplemental control element comprising a closed cylinder, a piston reciprocable in said cylinder, a valve stem connecting said piston and main control valve together, one side of said piston normally being under the pressure of the extinguishing fluid while the other side is free from pressure to hold the main control valve in closed position and means connecting said pressure-responsive means and automatically operable on actuation of said pressure relieving means to divert the pressure of the extinguishing fluid from its normal direction against the said one side of said piston to the opposite side while relieving said one side from any pressure to thereby force the main control valve into open position.

5. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in communication therewith and normally under the influence of air under pressure in excess of atmospheric pressure, normally closed fusible sprinkler heads mounted on the distributing pipes and adapted for opening under the influence of a predetermined degree of heat, a main control valve adapted to control the admission of said fluid to the system, means carried by said system for relieving said pipes from excess air pressure upon an abnormal rate-of-rise in temperature, pressure-responsive means connected to the distributing pipes and operable upon a loss in the amount of air pressure in said pipes, a supplemental control valve element comprising a cylinder, a piston reciprocable in said cylinder to provide two liquid chambers and a valve stem connecting said piston and main control valve together, a rotatable valve member, a pipe connection between the source of extinguishing fluid and said rotatable valve member, a pipe connection between one of said liquid chambers and said rotatable valve member, a drain pipe also connected to said rotatable valve member permitting a construction whereby the extinguishing fluid will flow from the source of supply into said one of said liquid chambers to exert pressure against said piston and retain the main control valve in closed position and to permit the extinguishing fluid in said second liquid chamber to flow to and

through said rotatable valve member and through said drain pipe, and means connected to said pressure-responsive means and automatically operable on actuation of said pressure-relieving means to move said rotatable valve member to a position whereby the extinguishing fluid will flow through said rotatable valve member and to the other of said liquid chambers to open said main control valve whereby the liquid in said first of said chambers will flow through said rotatable valve member and to and through said drain pipe.

6. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in communication therewith and normally under the influence of air under pressure, normally closed fusible sprinkler heads mounted on the distributing pipes and adapted for opening under the influence of a predetermined degree of heat, a main control valve adapted to control the admission of said fluid to the system, means carried by said system for relieving said pipes from excess air pressure upon an abnormal rate-of-rise in temperature, pressure-responsive means connected to the distributing pipes and operable upon diminution of the amount of air pressure in said pipes, a supplemental control valve element comprising a cylinder, a piston reciprocable in said cylinder and a valve stem connecting said piston and main control valve together, said piston normally being under the pressure of the extinguishing fluid to hold the main control valve in closed position, a pivoted detent connected to said pressure-responsive means and operable thereby, a weighted element normally held against movement by said detent and means actuated upon release of said weighted element to change the direction of pressure of the extinguishing fluid against the piston and thereby force the main control valve into open position.

7. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in communication therewith and normally under the influence of air under pressure, normally closed fusible sprinkler heads mounted on the distributing pipes and adapted for opening under the influence of a predetermined degree of heat, a main control valve adapted to control the admission of said fluid to the system, means carried by said system for relieving said pipes from excess air pressure upon an abnormal rate-of-rise in temperature, an air pressure chamber, a flexible diaphragm carried thereby and under the influence of the pressure of air in the distributing pipes, a supplemental control valve element comprising a cylinder, a piston reciprocable in said cylinder, means connecting said piston and main control valve together, a rotatable four-way valve connected to the source of extinguishing fluid and to either side of said piston to force it to move in a direction to either open or close the main control valve, a weighted element connected to said four-way valve and movable therewith and a pivoted detent engaging said diaphragm and normally holding said weighted element against movement and adapted to release the same to actuate the four-way valve upon diminution of pressure in the distributing pipes.

8. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in communication therewith and normally under the influence of air under pressure, normally closed fusible

sprinkler heads mounted on the distributing pipes and adapted for opening under the influence of a predetermined degree of heat, a main control valve adapted to control the admission of said fluid to the system, a relief valve connected to the system for permitting the escape of the air under pressure therein upon an abnormal rate-of-rise in temperature, an air pressure chamber, a flexible diaphragm carried thereby and under the influence of the pressure of air in the distributing pipes, a supplemental control valve element comprising a cylinder, a piston reciprocable in said cylinder, a rod connecting said piston and main control valve together, spring means exerting pressure against said piston to assist in retaining the main control valve in closed position, a shaft, a rotatable four-way valve mounted on said shaft and connected to the source of extinguishing fluid and to said cylinder at either side of said piston to close or open said main control valve by fluid pressure exerted against said piston, a weighted element mounted on said shaft and rotatable therewith and a pivoted detent engaging said diaphragm and normally holding said weighted element against movement and adapted to release the same to rotate said shaft and thereby change the position of said four-way valve to open said main control valve upon diminution of pressure in the distributing pipes.

9. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in communication therewith and normally under the influence of compressed air, normally closed fusible sprinkler heads mounted at intervals on the distributing pipes and adapted for fusing and opening under the influence of a predetermined degree of heat, a main control valve for controlling the admission of the extinguishing fluid to said distributing pipes, a relief valve connected to the system for permitting the escape of air under pressure in the distributing pipes upon an abnormal rate-of-rise in temperature to condition the system with extinguishing fluid prior to the opening of a sprinkler head, an air pressure chamber connected to the distributing pipes, movable means thereon operable upon the escape of the aforesaid air pressure, a supplemental control element connected to said main control valve and adapted to hold the main control valve in closed position by pressure exerted against said supplemental element by the extinguishing fluid in one direction, valve means connected to said movable means and to the source of extinguishing fluid for reversing the direction of pressure of the extinguishing fluid against said supplemental control element while freeing said control element from any pressure exerted in said one direction to open said main control valve upon diminution of pressure in said distributing pipes, a signal and a liquid pressure-responsive device connected to the source of extinguishing fluid and operable upon a diminution of the pressure of said extinguishing fluid from said source to energize said signal.

10. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in communication therewith and normally under the influence of compressed air, normally closed fusible sprinkler heads mounted at intervals on the distributing pipes and adapted for fusing and opening under the influence of a predetermined degree of heat, a main control valve for controlling the admission of the extinguishing fluid to

said distributing pipes, a relief valve connected to the system for permitting the escape of air under pressure in the distributing pipes upon an abnormal rate-of-rise in temperature to condition the system with extinguishing fluid prior to the opening of a sprinkler head, an air pressure chamber connected to the distributing pipes, movable means thereon operable upon the escape of the aforesaid air pressure, a supplemental control element connected to said main control valve and adapted to hold the main control valve in closed position by pressure exerted against said supplemental element by the extinguishing fluid in one direction, valve means connected to said movable means and to the source of extinguishing fluid for reversing the direction of pressure of the extinguishing fluid against said supplemental control element while freeing said control element from pressure in said one direction to open said main control valve upon diminution of pressure in said distributing pipes, a signal, a source of current supply connected to said signal, a liquid pressure-responsive chamber connected to the source of extinguishing fluid beneath the aforesaid main control valve and a switch connected to the source of current supply, to said signal and to said liquid pressure-responsive chamber and adapted to energize said signal upon diminution in the pressure of said extinguishing fluid.

11. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in communication therewith and normally under the influence of compressed air, normally closed fusible sprinkler heads mounted at intervals on the distributing pipes and adapted for fusing and opening under the influence of a predetermined degree of heat, a main control valve for controlling the admission of the extinguishing fluid to said distributing pipes, a relief valve connected to the system for permitting the escape of air under pressure in the distributing pipes upon an abnormal rate-of-rise in temperature to condition the system with extinguishing fluid prior to the opening of a sprinkler head, a supplemental control element connected to the main control valve and normally under the influence of the pressure of the extinguishing fluid in one direction to hold the main control valve in closed position, means automatically operable upon the aforesaid escape of air under pressure to reverse the direction of pressure of the extinguishing fluid against said supplemental control element while freeing said control element of pressure in said one direction and thereby open said main control valve, an air compressor connected to the system for automatically increasing the pressure of air therein when it falls below a predetermined amount, an automatic pressure-responsive switch connected to said air compressor and to the system and under the influence of the air pressure in the system, driving means connected to said air compressor and a source of current supply connected to said pressure-responsive switch and said driving means.

12. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in communication therewith and normally under the influence of compressed air, normally closed fusible sprinkler heads mounted at intervals on the distributing pipes and adapted for fusing and opening under the influence of a predetermined degree of heat, a main control valve for controlling

the admission of the extinguishing fluid to said distributing pipes, a relief valve connected to the system for permitting the escape of air under pressure in the distributing pipes upon an abnormal rate-of-rise in temperature to condition the system with extinguishing fluid prior to the opening of a sprinkler head, a supplemental control element connected to the main control valve and under the influence of the pressure of the extinguishing fluid in one direction to normally hold the main control valve in closed position, means automatically operable upon the aforesaid escape of air under pressure to reverse the direction of pressure of the extinguishing fluid against said supplemental control element while freeing said control element from pressure in said one direction and thereby open said main control valve, a gate valve positioned below the main control valve for controlling the flow of extinguishing fluid from the source of supply thereto, manual means for operating the same, a source of current supply, a switch associated with said gate valve and said source of current supply, a signal connected to said source of current supply and said switch and connecting means between said switch and gate valve and operable to close said switch and energize the signal upon manipulation of the manual means in a direction for closing the gate valve.

13. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a distributing pipe in connection therewith and normally under the influence of air under pressure, a normally closed fusible sprinkler head connected to said distributing pipe and adapted to open upon the attainment of a predetermined fixed degree of temperature, a rate-of-rise relief valve connected to the system for relieving the pressure of air therein upon a sudden rise in temperature to condition the system with extinguishing fluid prior to the opening of a sprinkler head, a main control valve for controlling the flow of the extinguishing fluid to the distributing pipe and operable for either opening or closing by selective pressure of the extinguishing fluid thereagainst in one direction while releasing pressure thereagainst in the opposite direction, said control valve being normally held closed by the pressure of said extinguishing fluid, an air pressure responsive device connected to the system and responsive to a variation in the air pressure therein and means connected to said air pressure responsive device and main control valve and automatically actuated by said air pressure responsive device to reverse the direction of pressure of the extinguishing fluid against said main control valve for opening the same.

14. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in connection therewith and with each other and normally under the influence of air under pressure, normally closed sprinkler heads connected to said distributing pipes and adapted to open upon the attainment of a predetermined fixed degree of temperature, a rate-of-rise relief valve connected to the system for relieving the pressure of air therein upon an abnormal rate of rise in temperature to permit the extinguishing fluid to flow to the distributing pipes and condition the system prior to the opening of a sprinkler head, a main control valve for controlling the flow of the extinguishing fluid to the distributing pipes and movable to open or closed position by pressure exerted thereagainst by the extinguishing fluid, an air pres-

sure responsive device connected to the system and responsive to a variation of the air pressure therein and valve means connected to said air pressure responsive device and said main control valve for automatically reversing the direction of pressure of the extinguishing fluid from one side of the main control valve to the other side while releasing said one side from pressure upon a variation in the air pressure in the system and thereby change the position of said main control valve.

15. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in connection therewith and with each other and normally under the influence of air under pressure, normally closed sprinkler heads connected to said distributing pipes and adapted to be opened upon the attainment of a predetermined fixed degree of temperature, means connected to the system for relieving the pressure of air therein upon an abnormal rate-of-rise of temperature to condition the system with extinguishing fluid prior to the opening of a sprinkler head, a main control valve for controlling the flow of the extinguishing fluid to the system, a supplemental device connected to said main control valve and normally subjected to the pressure of the extinguishing fluid in one direction to retain the main control valve in closed position, pressure-controlled actuating means connected to the system and means connected to said pressure-controlled actuating means and said supplemental device for automatically changing the direction of pressure of the extinguishing fluid against said supplemental device while releasing pressure thereagainst in the aforesaid one direction to move said main control valve into open position.

16. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in connection therewith and with each other and under the influence of the pressure of air of means for automatically relieving said distributing pipes from said air pressure upon a sudden rate-of-rise of temperature to condition the system with extinguishing fluid, normally closed sprinkler heads connected to said distributing pipes and adapted to open upon the attainment of a fixed degree of temperature, a main control valve for controlling the flow of extinguishing fluid from its source to said distributing pipes and movable by pressure of the extinguishing fluid, air pressure responsive means connected to the system and normally under the influence of the air pressure therein and a reversing valve connecting said main control valve and air pressure responsive means and adapted to open said main control valve upon actuation of said relieving means and a consequent decrease in pressure against said air pressure responsive means, said reversing valve being selectively operable to reverse the direction of pressure of the extinguishing fluid from one side of the control valve to the other side while simultaneously freeing said one side from fluid pressure.

17. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in connection therewith and with each other and normally under the influence of air under pressure, fusible sprinkler heads connected to said distributing pipes and operable upon the attainment of a predetermined fixed degree of temperature, a rate-of-rise relief valve connected to the system

for relieving the pressure of air therein upon a sudden rise in temperature to condition the system with extinguishing fluid prior to the opening of a sprinkler head, a main control valve for controlling the flow of the extinguishing fluid to the distributing pipes and operable by the pressure of the extinguishing fluid which normally holds the main control valve in closed position, an air pressure responsive device connected to the system and actuated by actuation of said relief valve, means connected to said air responsive device and main control valve and automatically actuated by said air responsive device to reverse the direction of pressure of the extinguishing fluid against the main control valve from one side thereof to the other side while simultaneously freeing said one side from fluid pressure for opening the same, a signal and means for actuating said signal comprising an extinguishing fluid responsive device therefor operative upon diminution of extinguishing fluid pressure.

18. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in connection therewith and with each other and normally under the influence of air under pressure, fusible sprinkler heads connected to said distributing pipes and operable upon the attainment of a predetermined fixed degree of temperature, a rate-of-rise relief valve connected to the system for relieving the pressure of air therein upon an abnormal rate of rise in temperature to condition the system with extinguishing fluid prior to the opening of a sprinkler head, a main control valve for controlling the flow of the extinguishing fluid to the distributing pipes and operable by the pressure of the extinguishing fluid which normally holds the main control valve in closed position, an air pressure responsive device connected to the system and actuated by actuation of said relief valve, a reversing valve connected to said air responsive device and main control valve and automatically actuated by said air responsive device to reverse the direction of pressure of the extinguishing fluid against the main control valve from one side thereof to the opposite side while simultaneously freeing said one side from fluid pressure for opening the control valve, an air pressure responsive device connected to the system, a switch connected thereto and adapted for closing upon a fall in pressure in said air responsive device and an air compressor connected to the system and to said switch for automatic actuation to increase the pressure of air in the system upon the closing of said switch.

19. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a plurality of distributing pipes in connection therewith and with each other and normally under the influence of air under pressure, fusible sprinkler heads connected to said distributing pipes and operable upon the attainment of a predetermined fixed degree of temperature, a rate-of-rise relief valve connected to the system for relieving the pressure of air therein upon an abnormal rate of rise in temperature to condition the system with extinguishing fluid prior to the opening of a sprinkler head, a main control valve for controlling the flow of the extinguishing fluid to the distributing pipes and operable by the pressure of the extinguishing fluid which normally holds the main control valve in closed position, an air pressure responsive device connected to the system and actuated by actuation of said

relief valve, means connected to said air responsive device and main control valve and automatically actuated by said air responsive device to change the direction of pressure of the extinguishing fluid against the main control valve from one side thereof to the opposite side while simultaneously freeing said one side from fluid pressure for opening the control valve, a gate valve for controlling the admission of the extinguishing fluid to the main control valve, a notched stem connected thereto, means connected to said stem for manually operating said gate valve, a signal and means engaging the notch in said stem when the gate valve is in open position and adapted to become disengaged from said notch to actuate said signal upon manipulation of said manual means in a direction to close said gate valve.

20. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a distributing pipe in connection therewith and normally under the influence of air under pressure, a normally closed sprinkler head connected to said distributing pipe and adapted to open upon the attainment of a predetermined fixed degree of temperature, a rate-of-rise relief valve connected to the system for relieving the pressure of air therein upon an abnormal rate of rise in temperature to condition the system with extinguishing fluid prior to the opening of the sprinkler head, a main control valve for controlling the flow of the extinguishing fluid to the distributing pipe and operable for opening or closing by the pressure of the extinguishing fluid thereagainst and normally held closed by said extinguishing fluid, an air pressure responsive device connected to the system and responsive to a variation in the air pressure therein, a reversing valve connected to said air responsive device and main control valve and automatically actuated by said air responsive device to change the direction of pressure of the extinguishing fluid against said main control valve from one side thereof to the opposite side while simultaneously freeing said one side from fluid pressure for opening the control valve, and means for giving a visual indication of the position of said main control valve.

21. In a fire controlling and extinguishing system, a source of extinguishing fluid under pressure, a distributing pipe in connection therewith and normally under the influence of air under pressure, a normally closed sprinkler head connected to said distributing pipe and adapted to open under the influence of heat to relieve the pressure of air in the distributing pipe and to discharge the extinguishing fluid, a main control valve for controlling the flow of the extinguishing fluid to the distributing pipe and operable for opening or closing by the pressure of the extinguishing fluid thereagainst and normally held closed by said extinguishing fluid, an air pressure responsive device connected to the system and responsive to a variation in the air pressure therein and a reversing valve connected to said air responsive device and said main control valve

and automatically actuated by said air responsive device to change the direction of pressure of the extinguishing fluid against said main control valve for opening the same, said reversing valve being selectively operable to permit the full pressure of the extinguishing fluid to be exerted against said main control valve in one direction while simultaneously freeing said control valve from pressure exerted in a different direction.

22. In a fire controlling and extinguishing system, a source of extinguishing fluid, a riser connected to the system, a distributing pipe connected to said riser, said riser and distributing pipe normally containing air under pressure other than atmospheric pressure, a main control valve for controlling the supply of extinguishing fluid to said riser and distributing pipe and adapted to be moved to closed and open position by the pressure of the extinguishing fluid and to be held in either position by said fluid, a normally closed sprinkler head mounted on said distributing pipe and adapted to be opened upon the attainment of a predetermined degree of temperature, a relief device communicating with said sprinkler head and automatically operable upon an abnormal rate-of-rise in temperature to vary the amount of the pressure of air in the riser and distributing pipe sufficiently to condition them for the reception of extinguishing fluid upon the opening of the main control valve and prior to the opening of the sprinkler head, a pressure-responsive device connected to the system and responsive to a variation of pressure therein and means controlled by said pressure-responsive device and controlling the operation of the main control valve, said means being operative to control the flow of the extinguishing fluid to close the valve and to normally hold it closed when the pressure-responsive device is inactive and to control the flow of the extinguishing fluid to open the valve when the pressure-responsive device is actuated.

23. In a dry-pipe fire controlling and extinguishing system, a source of extinguishing fluid, a riser connected to the system, a distributing pipe connected to said riser, said riser and distributing pipe normally being free from extinguishing fluid, a main control valve for controlling the supply of extinguishing fluid to said riser and distributing pipe and adapted to be moved to closed and open positions by the extinguishing fluid and held in either position by said fluid, a normally closed sprinkler head mounted on said distributing pipe and adapted to open under the influence of heat, a pressure-responsive device connected to the system and operable upon the opening of the sprinkler head and means controlled by said pressure-responsive device and controlling the operation of the main control valve, said means being operative to control the flow of the extinguishing fluid to close the valve and to normally hold it closed when the pressure-responsive device is inactive and to control the flow of the extinguishing fluid to open the valve when the pressure-responsive device is actuated.

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