

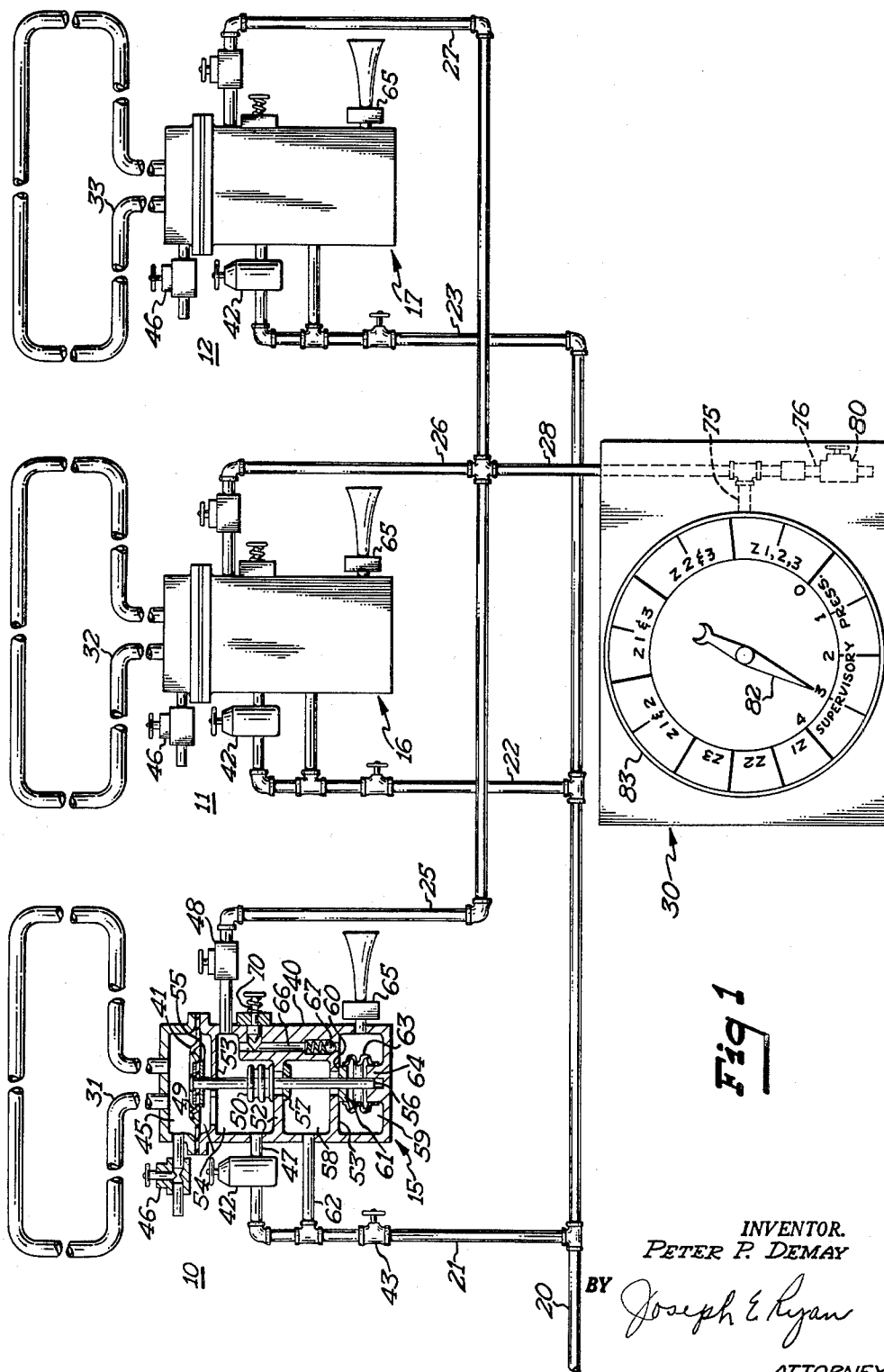
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PNEUMATIC FIRE ALARM SYSTEM

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PNEUMATIC FIRE ALARM SYSTEM

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My invention relates to pneumatic alarm systems and more particularly to an improved pneumatic fire alarm with supervisory indication and alarm indication for a selected number of a plurality of zone detectors.

While fire alarm systems or trouble detecting systems of the pneumatic type are known and used, the present invention is directed to an improved pneumatic fire alarm system which is of the all-pneumatic type. It includes supervisory type control and selective indication of trouble at a plurality of zones through bleed rate in a pneumatic system. Therefore, it is an object of this invention to provide an improved pneumatic fire alarm system. A further object of this invention is to provide in an improved fire alarm system zone identification through the use of a single pneumatic pipe or conduit from the zone locations to the supervisory control and alarm. Another object of this invention is to provide in an apparatus of this type an improved arrangement for zone identification through the use of differing bleed rates between zones. A still further object of this invention is to provide an improved pneumatic fire alarm system with a single indicator to indicate alarm signals for the plurality of zones. These and other objects of this invention will become apparent from a reading of the attached description and drawing in which:

The drawing is a schematic diagram of an embodiment of the invention utilizing an all-pneumatic fire alarm system.

The drawing shows a schematic diagram of the improved system in which an installation for fire detection purposes is contemplated utilizing a plurality of zones or three zones indicated generally at 10, 11 and 12. Positioned in each zone is a zone controller 15, 16 and 17, each zone controller being supplied with a pneumatic source of power from a common supply conduit indicated generally at 20, which supply conduit is connected to a source of air such as a compressor (not shown). The common supply conduit has connected thereto branch taps or conduits 21, 22 and 23 leading respectively to the zone controllers or detectors 15, 16 and 17. The individual detectors 15, 16 and 17 also have leading therefrom output conduits or pipes 25, 26 and 27 which are connected in common through a pipe 28 leading to a remote positioned indicating apparatus indicated generally at 30. This indicator or indicating apparatus would normally be positioned some distance from the individual zone locations and at a common supervisory point for an installation such that only a single pipe from the individual zones to transmit the alarm and monitoring signals, to be later defined, is required. The individual supply conduit from the common source conduit 20 can be located in the zones, if desired.

Thus, as will be seen in the drawing, each zone is connected to the pneumatic source through the supply conduit 21, 22 and 23 and in addition to the outlet piping 25, 26, 27 connected thereto, includes a zone detecting loop or pipe 31, 32 and 33 respectively which are distributed about the respective zones for sensing purposes. Since all of the zone detectors or controllers are identical with respect to one another except for the fact that their orifice sizing differs, as will be later noted, only one will be described in detail. Thus the zone detector 15 includes a casing 40 which has connected thereto a supply

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conduit 21 leading to a pressure reducing and regulating valve 42, which is conventional in form and shown in block form for simplicity, with conduit 21 including a shutoff valve 43. The casing 40 includes a chamber 45 defined by a diaphragm 41 in one end of the casing 40 to which the ends or extremities of the pipe or zone loop in the conduit 31 are connected. This chamber 45 also includes a pipe leading through an adjustable bleed orifice 46 vented to atmosphere and the diaphragm includes an orifice or passage therein indicated at 49. Casing 40 includes a dividing partition 52 which defines with the diaphragm 41 a main chamber 54 to which the pressure reducing valve 42 is connected. A guide plate 53 is positioned in this area or chamber and guides a shaft 56 connected to a thrust plate 55 on diaphragm 41. Shaft 56 extends through the guide plate 53 and partition 52 for purposes which will be later noted. The pressure reducing valve 42 establishes through the fixed orifice 49 in diaphragm 41 a pressure in the chamber 45 as well as in chamber 54 which is present in the loop 31. Air from the chamber 45 is bled through the first adjustable orifice 46 to atmosphere and the chamber 54 will also adjust to this pressure, normally. The bleed 46 is adjusted to provide a given pressure and flow rate or bleed rate from the chamber 45. Positioned within the chamber 54 is a bellows 50 which seals the shaft 56 and the chamber 54 at partition 52. The operating shaft 56 extends through partition 52 and into an inlet cavity or chamber 58 connected by means of a pipe 62 directly to the inlet conduit or pipe 21 ahead of the reducing valve 42. The shaft 56 extends through chamber 58 and into another chamber 59 in controller 15 in which is positioned a valve 57. The opening in the casing through which shaft 56 extends defines a valve seat indicated generally at 60 which has cooperating therewith a valve closure member 61 to form the valve 57 controlling the air flow which enters the inlet cavity or chamber 58 from pipe 62 and passes to the chamber 59. Chamber 59 also has associated therewith a horn or audible warning means indicated generally at 65 which horn is controlled by the valve ports 60, 61 and which is operated by the unregulated air supply from the conduit 62 as controlled by the valve. For purposes which will be later noted, valve closure member 61 has associated therewith a bellows seal 63 which connects to the casing in chamber 59 and prevents air pressure in chamber 59 from applying a force to the bottom of the closure member 61. Shaft 56 extends through the bellows 63 and is journaled in a hub 64 in casing 40.

In addition to the above, the casing 40 also includes an additional conduit or pipe, indicated generally at 66, which conduit has a check valve 67 located therein and connects the chamber 59 with the chamber 54. A manually operated momentary closing valve 70 is also included in this conduit for reset purposes since depression of the valve stem will close valve 70 and the passage 66 between the chambers 59 and 54, for purposes to be later noted.

The zone detectors 16 and 17 are of the same structure and differ from the zone controller or detector 15 and from one another only in the settings of the adjustable orifices 46 and 48. The varying outputs from the zone detectors or controllers 15, 16 and 17 are varying flow rates connected to the common pipe 28 leading to the remotely positioned apparatus or indicator 30. The indicator 30 herein is of the pneumatic type and is pressure responsive. As indicated schematically in the drawing, the pipe 28 leads to the indicator 30 through a cross pipe 75 with a bleed pipe 76 extending beyond the same and including an adjustable restriction 80 used for calibrating the instrument. As will be noted, the indicator has

a pointer 82 which cooperates with an indicia indicated generally at 83 which is divided up into various segments or pressure ranges indicating the pressure supplied through the outlet conduit. Thus the indicator indicates supervisory pressure at the zones and for the purpose of the present disclosure the three zones and the combinations of the three zones to indicate a fire or alarm in any one individually or any combination of the three and, in addition, the standby pressures at all of the zones for monitoring purposes as will be later explained.

In operation each of the individual zone detectors work alike. The air supplied to the outlet conduit is supplied directly to the indicator 30 as indicated by the conduit or piping 25, 26, 27 and 28 through adjustable orifice restriction 48. The input to the detector is through reducing valves 42 and by direct connection to the supply conduits. The chambers 54 and 45 of each detector have a predetermined pressure supplied thereto which pressure is determined by the setting of the reducing valve 42 and bleed rates established by the orifices 46. The loop detecting conduit 31, 32, 33 positioned throughout the zone in which fire detection is sought will be exposed to the ambient temperature of the zone and will upon the presence of a predetermined rate of rise in temperature in the zone, indicate a conflagration or fire, cause the pressure in the respective chamber 45 of the controllers to rise above the pressure determined by the orifices 46, 48. This rise in pressure will act on the diaphragm 41 which forms a side of the chamber 45 causing the diaphragms with the shaft 56 operatively connected thereto to deflect. Thus, the rise in pressure in chamber 45 will cause diaphragm 41 to deflect downward moving the operating shaft 56 and hence the valve closure member 61 associated therewith or mounted thereon to open the valve formed by the valve seat 60 and closure member 61. Bellows 50 seals the shaft 56 and completes the chamber 54. The pressure thereon added to the downward force exerted on the closure member 61 by pressure in chamber 58 is offset by the pressure of the chamber acting within the bellows 50 in an opposite or upward direction. The valve closure member 61 is sealed on its downstream side so that the pressure in chamber 59 with valve 60, 61 open will not tend to close the valve. Thus, the rise in pressure in chamber 45 will primarily control the opening of this main valve 60, 61. This connects the high pressure in conduit 62 and chamber 58 to the chamber 59 of the controller. High pressure air, when allowed to enter the chamber 59, will cause the horn 65 to operate and will at the same time pass through the passage 66 in the controller past the directional check valve 67 which is positioned to allow air to move from chamber 59 to chamber 54. This further increases the pressure in chamber 54 establishing a new bleed rate through the orifice 48 and conduit 25 to the indicator 30. The high pressure within the chamber 54 in addition performs a latching or locking function in that it increases the force on the bellows 50 in a downward direction and holds the valve 60, 61 open, allowing high pressure air from the main conduit 21 to enter the controller operating the indicating horn in the zone location and increasing the bleed rate from the zone detector 15 to the outlet passage 25.

The same operation will occur in any of the zones 15, 16 or 17 and may occur simultaneously in the event an ambient temperature rise is experienced in all zones. Under normal operation and without the presence of fire or rise in temperature surrounding the zone piping 31, 32 or 33, the bleed rate established from each of the detectors will be fed through the outlet passage or single outlet pipe 28 to the indicator or indicating apparatus 30 can cause the needle thereof to be deflected in the supervisory pressure range or lower pressure range to indicate that air is being supplied to the individual controllers. If all zones are receiving this indicating apparatus will indicate the same by having its indicating needle 82 move

to position 3 through the presence of sufficient air pressure at a predetermined bleed rate to overcome the pressure responsive means in the indicator. In the event that any one or more of the zones have leaks therein or are plugged, or have improperly set regulating valves, the normal flow rate without the high pressure valving being open will sufficiently change the bleed rate at the zone detector so that the needle will be moved from its normal position indicating trouble at one or more of the zones. Each of the zones has a different bleed rate in the normal operating range through adjustment of the orifices 48 so that the combined effect will produce one pressure at a particular bleed rate to make up a predetermined total pressure drop at the indicator for supervisory purposes. Thus, any zone or combination of zones being inoperative will be indicated by the improper positioning of the needle on the indicia so that the apparatus will be under continuous monitoring at all times.

In the event of fire or conflagration in any zone, the bleed rate will increase for that particular zone and the needle will be moved into the range corresponding with the indicia markings identifying the respective zones. Thus, for example with all zones operating and assuming a 35 p.s.i. main line pressure, the pressure drop due to the normal monitoring signals will be 4 lbs. p.s.i. or less on the indicator. The pressure drop in zone 1 with high pressure air applied thereto because of the orifice sizing alone will increase the pressure drop at the indicator to a first level, for example 4½ lbs., moving the pointer to the indicia section marked Z-1. Similarly, the drop caused by the bleed rate in zone 2 would present a 7 p.s.i. drop and that in zone 3 would present a 13 p.s.i. drop. The combination of zones 1 and 2 would produce a 15 p.s.i. drop at the indicator, zones 1 and 3 a 19 p.s.i. drop at the indicator, zones 2 and 3 a 21 p.s.i. drop at the indicator, and all zones 1, 2 and 3 operating would produce a 24½ p.s.i. drop at the indicator, moving the pointer to positions Z-1, 2 and 3. Thus, the pressure responsive device will indicate alarm for any one of the zones or any combination of the zones and will indicate the operating pressure at any one of the zones or any combination of the zones.

This apparatus provides an all-pneumatic alarm system with a visual indication at the supervisory point. Further, it provides for audible alarm in the individual zones at the zone detector location although it may be understood that the horn or alarm device may be connected through a suitable length of piping to a somewhat remote point from the detector if desired. Further, it will be understood that an individual zone may be removed from the loop for repair or inspection purposes merely by closing the shutoff valve 43 at the inlet supply to the same and closing the bleed orifice 48 at the output side of the same to prevent any backflow from the other detectors on the line. Once the alarm has been sounded, it will continue to operate until such a time as the manual resetting device or valve 70 is operated to block the passage 66 and allow the pressure within the chamber 54 to drop through the bleed to the normal valve, assuming that the ambient temperature surrounding the loop has again reached a normal level. The operation of this manual reset valve by closing the passage 66 will prevent the high pressure air from chamber 59 from entering chamber 54 and hence chamber 45 so that the diaphragm 41 or pressure responsive means will be allowed to move to its normal position under the presence of normal pressure in chamber 45, closing the valve 60, 61 operated thereby to seal off the high pressure source from the conduit 62 to the audible warning means and the chamber 59. This will return the individual zone detector to a normal operation and the original low level bleed rate for monitoring purposes will again be established in the outlet conduit to be indicated on the indicator or indicating apparatus 30.

In considering this invention it should be remembered

that the present disclosure is intended to be illustrative only and the scope of the invention should be determined only by the appended claims.

I claim as my invention:

1. A pneumatic fire alarm system comprising, a source of pneumatic pressure, a plurality of zone detecting controllers adapted to be positioned respectively in a plurality of zones in which fire detection is desired, a pressure regulator associated with each detecting controller, means connecting said source of pneumatic pressure to said pressure regulators and said controllers, each of said detecting controllers having a first chamber therein to which the respective pressure regulator is connected and adjusted to supply the same at differing pressures, a sealed loop conduit for each controller connected respectively at its extremities to said controller and being pressurized by the pressure in said first chamber, said loop conduits being adapted to be distributed respectively within the zones in which fire detection is desired, a first adjustable restriction included in each controller and venting respectively said first chambers to atmosphere, a second adjustable restriction included in each controller and connected to said first chamber, a common indicator for all of said zone controllers, conduit means connecting all of said second restrictions through a common conduit to said indicator, pressure responsive means associated with said first chamber and including a shaft in each of said controllers, a second chamber in each of said controllers, said shaft in each of said controllers extending into said second chambers, valve means positioned in said second chamber of each controller and operatively connected to and operated by the pressure responsive means in said first chamber of each controller, additional conduit means connected to said second chamber of each controller and to said source of pneumatic pressure independent of said pressure regulators to provide an unregulated higher pressure therein, further conduit means within each of said controllers connecting said second chamber with said first chamber and including a directional check valve, audible alarm means mounted on each of said controllers and connected to said second chambers being responsive to the pressure therein valved by said valve means with movement of said pressure responsive means, said further named conduit means permitting flow of air from said second chamber to said first chamber in each controller to perform a latching function on said valve means once movement of said pressure responsive means is initiated, the unregulated higher pressure of said second chamber communicating through said further conduit means to said first chamber and establishing with said first and second restrictions in each controller a predetermined bleed rate and a predetermined pressure in said first named conduit means leading to said indicator, the pressure in said loop conduits for each controller being caused to increase with an increase in temperature beyond a predetermined point and rate of ambient temperature change in the respective zones to cause said pressure responsive means to open said valve means in said second chamber sounding said audible alarm at said controller and latching said valve in an open position to supply pressures to said indicator indicative of the respective controller actuated, the second adjustable restrictions in said controllers being adjustable such that each zone controller has a different bleed rate from said first chamber such that the indicator responds to normal conditions of operation for each of the controllers to provide a given output therefrom and a selected indication from each of said controllers in the event of predetermined rise in ambient temperature around their associated loop conduits.

2. A pneumatic fire alarm system comprising, a source of pneumatic pressure, a plurality of zone detecting controllers adapted to be positioned respectively in a plurality of zones in which fire detection is desired, a pressure regulator associated with each detecting controller, means connecting said source of pneumatic pressure to said

pressure regulators and said controllers, each of said detecting controllers having a first chamber therein to which the respective pressure regulator is connected and adjusted to supply the same at differing pressures, a sealed loop conduit for each controller connected respectively at its extremities to said controller and being pressurized by the pressure in said first chamber, said loop conduits being adapted to be distributed respectively within the zones in which fire detection is desired, a first adjustable restriction included in each controller and venting respectively said first chambers to atmosphere, a second adjustable restriction included in each controller and connected to said first chamber, a common indicator for all of said zone controllers, conduit means connecting all of said second restrictions through a common conduit to said indicator, pressure responsive means associated with said first chamber and including a shaft in each of said controllers, a second chamber in each of said controllers, said shaft in each of said controllers extending into said second chambers, valve means positioned in said second chamber of each controller and operatively connected to and operated by the pressure responsive means in said first chamber of each controller, additional conduit means connected to said second chamber of each controller and to said source of pneumatic pressure independent of said pressure regulators to provide an unregulated higher pressure therein, further conduit means within each of said controllers connecting said second chamber with said first chamber and including a directional check valve, audible alarm means mounted on each of said controllers and connected to said second chambers being responsive to the pressure therein valved by said valve means with movement of said pressure responsive means, said further named conduit means permitting flow of air from said second chamber to said first chamber in each controller to perform a latching function on said valve means once movement of said pressure responsive means is initiated, the unregulated higher pressure of said second chamber communicating through said further conduit means to said first chamber and establishing with said first and second restrictions in each controller a predetermined bleed rate and a predetermined pressure in said first named conduit means leading to said indicator, the pressure in said loop conduits for each controller being caused to increase with an increase in temperature beyond a predetermined point and rate of ambient temperature change in the respective zones to cause said pressure responsive means to open said valve means in said second chamber sounding said audible alarm at said controller and latching said valve in an open position to supply pressures to said indicator indicative of the respective controller actuated, the second adjustable restrictions in said controllers being adjustable such that each zone controller has a different bleed rate from said first chamber such that the indicator responds to normal conditions of operation for each of the controllers to provide a given output therefrom and a selected indication from each of said controllers in the event of predetermined rise in ambient temperature around their associated loop conduits, and reset valve means positioned in said further conduit means and including a manually operating means extending outside of said controller being adapted to block said further conduit and isolate the pressure in said second chamber from the pressure in said first chamber for reset purposes.

3. A pneumatic alarm system comprising: a plurality of zone detectors each including a controller and a loop conduit adapted to be distributed within a zone in a space in which detection is sought, a supply conduit connected to each controller, an output signal pressure conduit means connected to each controller and including a common conduit means, a remote supervisory and trouble indicator, further conduit means connecting said indicator to said common conduit means, said remote indicator including pressure responsive means responsive to different

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bleed rates from said respective controllers to give variable indications depending upon the pressure in said controllers, means including a pressure reducing and bleed adjusting means included as a part of each controller to establish a first pressure in said loop conduit at a first bleed rate from each controller to said indicator, means responsive to the rate of rise of ambient temperature around any of said loop conduits to establish at said respective controller a second pressure therein at a second bleed rate from the controller to said indicator, each of said controllers having different second pressures and bleed rates to alter the output pressure in said common conduit means leading to said indicator with an increase in the second pressure and bleed rate in any one or more of said zone controllers.

4. A pneumatic alarm system comprising: a plurality of zone controllers each including a controller and a loop conduit adapted to be distributed within a zone of a space in which detection is sought, a supply conduit means connected to each controller, an output signal pressure conduit means connected to each controller, an output signal pressure conduit means connected to each controller and including a common conduit, a remote supervisory and trouble indicator, further conduit means connecting said indicator to said common conduit means, said remote indicator including pressure responsive means responsive to different bleed rates from said respective controllers to give variable indications depending upon the pressures within said controllers, means including bleed adjusting means included as a part of each controller to establish a given bleed rate from each controller with given pressures therein, means responsive to a rise in ambient temperature around the loop conduit in any one of said zone controllers to establish at said respective zone controller a second pressure therein and a second bleed rate from the controller to said indicator, each of said controllers having different first and second pressures and bleed rates to alter the output pressure in said common conduit leading to said indicator.

5. A pneumatic alarm system comprising; a plurality of zone detectors each including a controller and a loop conduit means adapted to be distributed within a zone of the space in which detection is sought, a supply pressure conduit connected to each controller, an output pressure conduit means connected to each controller and including a common conduit means, a remote supervisory and trouble indicator, further conduit means connecting said indicator to said common conduit means, said remote indicator including pressure responsive means responsive to different bleed rates from said respective controllers to give variable indications depending upon the pressures in said controllers, means including an adjustable orifice means included as a part of each controller to establish a first pressure in said loop conduit of each controller, means responsive to a rise in ambient temperature around any of said loop conduits to raise at said respective controller said pressure therein and establish a predetermined second bleed rate from said controller to said indicator, each of said controllers having different bleed rates, and audible warning means at each controller connected to said controller and operated by the higher of the pressures in said controllers.

6. A pneumatic fire alarm system comprising, a source of pneumatic pressure, a plurality of zone detecting controllers, said controllers each including a chamber connected to said pneumatic pressure source, a sealed loop conduit for each controller connected at its extremities to said chamber and adapted to be distributed respectively within a plurality of zones in which fire protection is desired, adjustable means connected to the chambers of each of said controllers to provide a first bleed rate from said chambers upon the presence of a first pressure in the chambers of said controllers and a second bleed rate upon the presence of a second pressure in the chambers of said controllers, conduit means connecting

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the chambers of all of said controllers in common, a pneumatic indicator, means connecting the common conduit means to said indicator to receive flow at said first and second bleed rates from said controllers, audible indicating means mounted on each of said controllers and connected thereto being responsive to the second pressures therein, the first pressures in said controllers being caused to rise to said second pressures upon an increase in temperature beyond a predetermined point around said loop conduit, the individual controllers being separately adjustable such that each controller has a different first and second bleed rate therefrom such that said indicator can respond for a selected indication from each of said respective controllers in the event of a predetermined rise in ambient temperature at said respective loop conduits.

7. A pneumatic fire alarm system comprising, a source of pneumatic pressure, a plurality of zone detecting controllers, said controllers each including a chamber connected to said pneumatic pressure source, a sealed loop conduit for each controller connected at its extremities to said chamber and adapted to be distributed respectively within a plurality of zones in which fire protection is desired, adjustable means connected to the chambers of each of said controllers to provide a first bleed rate from said chambers upon the presence of a first pressure in the chambers of said controllers and a second bleed rate upon the presence of a second pressure in the chambers of said controllers, conduit means connecting the chambers of all of said controllers in common, a pneumatic indicator, means connecting the common conduit means to said indicator to receive flow at said first and second bleed rates from said controllers, audible indicating means mounted on each of said controllers and connected thereto being responsive to the second pressures therein, the first pressures in said controllers being caused to rise to said second pressure upon an increase in temperature beyond a predetermined point around said loop conduits, the individual controllers being separately adjustable such that each controller has a different first and second bleed rate therefrom such that said indicator can respond for a selected indication from each of said respective controllers in the event of a predetermined rise in ambient temperature at said respective loop conduits, and means included at each controller for resetting the respective controllers from said second bleed rate to said first bleed rate after a rise in ambient temperature around said loop conduits.

8. A pneumatic alarm system comprising; a plurality of zone detectors each including a controller and a loop conduit adapted to be distributed within a zone of a space in which detection is sought, a supply pressure conduit connected to each controller, an output signal pressure conduit connected to each controller and including a common conduit means, a remote supervisory and trouble indicating apparatus, means connecting said indicating apparatus to said common conduit means, said remote indicating apparatus including pressure responsive means responsive to differing bleed rates from said respective controllers to give variable indications to identify the respective zone controllers, means including a pressure reducing and bleed adjusting means included as a part of each controller to establish a first pressure in said loop conduit and a first bleed rate in each controller, means included in each controller responsive to a rise in ambient temperature around the loop conduit to establish at the respective controller a second pressure therein and a second bleed rate from the controller to provide a predetermined output pressure to said output signal pressure conduit, audible warning means connected to each controller and responsive to said second pressure, each of said controllers having different first and second pressures and bleed rates to provide different output pressure signals in said common conduit leading to the indicating apparatus.

9. A pneumatic alarm system comprising; a plurality of zone detectors each including a controller and a loop conduit adapted to be distributed within a zone of a space in which detection is sought, a supply pressure conduit connected to each controller, an output signal pressure conduit connected to each controller and including a common conduit means, a remote supervisory and trouble indicating apparatus, means connecting said common conduit means to said indicating apparatus, said remote indicating apparatus including pressure means responsive to different bleed rates from said respective controllers to give variable indications to identify respective zone controllers, means including bleed means included as a part of each controller to establish a first pressure in said loop conduit in each controller, means included in each con-

troller responsive to a rise in ambient temperature around the loop conduit to establish at the respective controllers a bleed rate therefrom to provide a predetermined output pressure in said output pressure conduit, audible warning means connected to each controller and operated upon a change in pressure in said loop conduit, each of said controllers having different bleed rates to provide different output pressure signals in said common conduit leading to said indicating apparatus with an increase in bleed rates at any one of said zone controllers.

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