Jan. 7, 1936. W. M. SIDDALL, JR 2,027,068

FIRE ALARM SYSTEM

Filed Sept. 3, 1932

Fig. 1

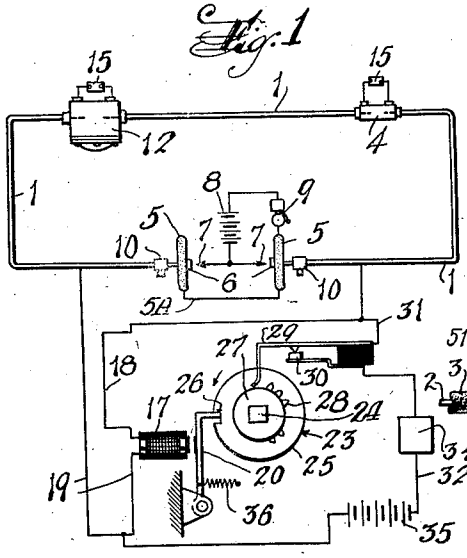


Fig. 2

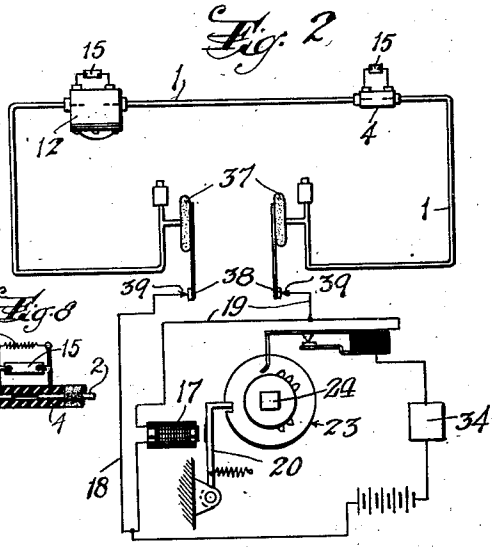


Fig. 8

Fig. 3

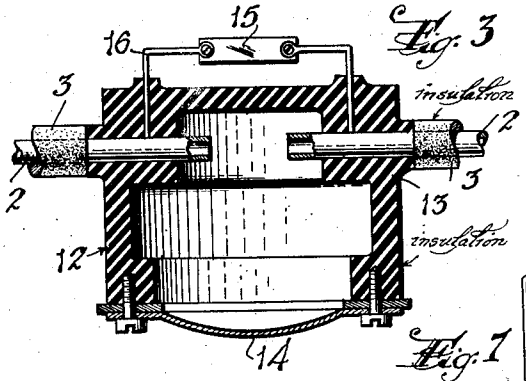


Fig. 4

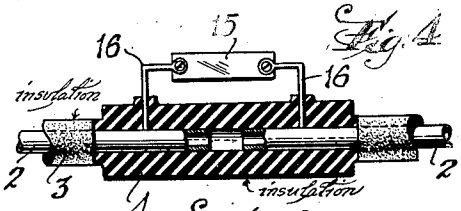


Fig. 6

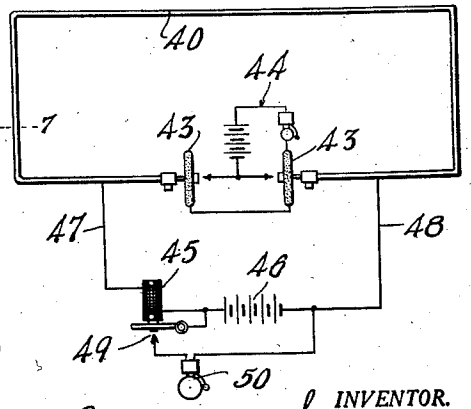


Fig. 7



Fig. 5

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FIRE ALARM SYSTEM

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18 Claims. (Cl. 177—355)

This invention relates to automatic fire alarm systems in which thermo-responsive mechanisms are utilized, both of the fluid pressure so-called "rate-of-rise" type and of the so-called "fixed temperature" type having circuit changing mechanism arranged for response to temperature increases of more than predetermined extent, as through control by a fusible or thermostatically distortable member.

Among the objects of my invention are to provide a novel and improved combination of a fluid pressure fire alarm system and an electrical fire alarm system of the general character described wherein the two systems may initiate signals independently of each other so that the advantages of both systems shall be obtained in the same installation and protection against fire shall be greatly increased by the two superposed or combined systems; and to provide such a combination system wherein the tubing of the fluid pressure system shall serve also as an electrical conductor, instead of wiring, for the electrical system, so upon a break in the tubing a signal shall be operated, whereby both the tubing and the electrical circuit shall be under constant test or constantly supervised and trouble in the system can be quickly discovered and remedied.

Another object is to provide such a combined fluid pressure and electrical fire alarm system embodying novel and improved features of construction wherein the fluid pressure system may be utilized to operate a local signal in case of fire, for example a fire of short duration or low temperature, and the electrical system may operate a distant or central signal after a fire has continued for a certain time or has caused a predetermined higher temperature.

Further objects are to provide a combined fluid pressure and electrical fire alarm system embodying novel and improved features of construction including a loop of tubing, wherein both the signal-initiating fluid pressure actuated device and the thermo-responsive device control operation of one and the same signal-actuating means; and to provide in such a system novel and improved means whereby one central source of electricity shall serve in the supervision of both the fluid pressure and the electrical systems, and for operating the signal-actuating means, whereby a simple, compact and inexpensive fire alarm system shall be obtained.

Other objects are to provide in a combined fluid pressure and electrical fire alarm system, novel and improved means for connecting the thermo-responsive signal-initiating device of the electrical system to the tubing of the fluid pressure system; to provide a combined fluid pressure and electrical fire alarm system wherein the tubing shall be formed of sections having their ends in spaced relation which shall be connected by sleeves or nipples of insulation, and the thermo-responsive signal-actuating devices shall be electrically connected across or bridge said spaced and insulated ends of the tubing sections so that said tubing sections and said thermo-responsive devices can be electrically connected in series; to provide a fluid pressure fire alarm system which shall be under constant test or electrical supervision by connection of the tubing in an electrical signalling circuit and enclosing the tubing in electrical insulation, so that a break in said tubing will interrupt the electric circuit and cause operation of the signal; to provide novel and improved means associated with the thermo-responsive circuit changing mechanism operable upon operation of said mechanism for identifying the location where such mechanism has been operated; and to obtain other advantages and results as will be brought out by the following description.

Referring to the accompanying drawing in which corresponding and like parts are designated throughout the several views by the same reference characters,

Figure 1 is a diagrammatic illustration of a combined fluid pressure and electrical fire alarm system embodying my invention.

Figure 2 is a similar view of another form of the invention.

Figure 3 is an enlarged vertical sectional view through one of the air chambers forming a part of the fluid conduit.

Figure 4 is a similar view of one of the insulating nipples forming a part of the fluid conduit.

Figure 5 is a composite sectional elevation showing the insulating connection to the tubing of one of the fluid pressure actuated signal-initiating devices.

Figure 6 is a diagrammatic illustration of a modification of the invention,

Figure 7 is an enlarged transverse sectional view on the line 7—7 of Figure 6, and

Figure 8 is a view similar to Figure 4, showing another modification of the invention.

Specifically describing the embodiment of the invention illustrated in Figures 1, 3 and 4, my fire alarm system includes a conduit containing a fluid which is a non-conductor of electricity extending through the area to be protected against fire, which is shown as composed of a plurality

of sections 1 of electricity conducting tubing 2 which is enclosed in a casing of electrical insulating material 3. The adjacent ends of certain of the sections 1 are connected together in electrically insulated relation as by sleeves or nipples 4 of electrical insulating material which telescopically receive the ends of the sections of the tubing and hold them in spaced relation to form a continuous conduit for fluid.

At each end of the fluid conduit is connected a fluid actuated signal-initiating device 5, for example a diaphragm of known construction, at least one wall of which will be moved or distended by fluid pressure generated in the fluid conduit by the heating of any part of the length thereof. These signal-initiating devices cooperate with a signal actuating mechanism for producing a signal upon increase in pressure in the fluid conduit. As shown, the devices 5 are electrically connected by a wire 5A and each of them has an electric switch contact 6 which cooperates with another contact 7 to control a circuit including the signal-initiating device, a source of electricity 8 and a signal, for example a bell 9. The switch contacts 6 and 7 are normally in spaced relation but upon an increase in pressure in the tubing of a predetermined amount, the contacts 6 and 7 are moved into engagement by the devices 5 so as to cause an actuation of the signals 9. Obviously, only one signal initiating device is necessary, and any other suitable signal actuating mechanism might be utilized.

The signal-initiating devices 5 are connected to the fluid conduit in electrically insulated relation, as by a sleeve 10 of electrical insulating material (see especially Fig. 5), and a suitable vent or breathing opening is provided for each signal-initiating device to permit the fluid pressure in the conduit to become reduced to atmospheric pressure after such pressure in the conduit has been increased by heat. As shown, this vent consists of a restricted passage 11 in the sleeve 10 which communicates with the signal-initiating device.

If desired, the capacity of the fluid conduit may be increased to provide quicker response of the signal initiating devices to heat, by the use of air chambers 12. These air chambers are connected between the sections 1 of the conduit in insulated relation thereto, and as shown each air chamber comprises a body 13 formed of insulating material through the walls of which the ends of the tubing sections extend in spaced relation to each other as clearly shown in Figure 3 of the drawing. The air chamber preferably has a removable cover 14, and the capacity of the air chamber may be varied by interchanging covers having different degrees of concavity.

In accordance with the invention, the tubing 2 of the fluid conduit also serves as an electrical conductor instead of wiring, for an electrical fire alarm system, and the adjacent ends of the tubing sections are electrically connected by thermo-responsive circuit changing mechanism 15 of suitable known construction; such, for example, as bi-metallic thermo-responsive or fusible metal strips, that illustratively indicated being mounted on the insulating sleeves or nipples 4 and/or the air chambers 12, by means of suitable supports 16 which are in electrical contact with the tubing sections, but such mechanism may be part of a standard sprinkler head of a sprinkler system. With this arrangement, the thermo-responsive circuit changing mechanisms 15 bridge the gaps between the ends of the tubing sections and the tubing sections are electrically connected in circuit with each other, while the thermo-responsive circuit changing mechanism is electrically connected in series circuit with the tubing sections. The thermo-responsive circuit changing mechanism may be normally closed and operable at a predetermined temperature so as to open the circuit in case of fire in the vicinity thereof, as shown, or the circuit changing mechanism may be constructed to otherwise control the circuit or vary the resistance therein. The ends of the fluid conduit are electrically connected in circuit with a signal actuating mechanism of any suitable known construction; preferably a relay or trip including an electromagnetic coil 17 which has one terminal electrically connected to the tubing at one end of the conduit and its other terminal connected to the tubing at the other end of the conduit by the respective wires 18 and 19. The coil 17 cooperates with an armature detent 20 which controls a spring actuated signal operating mechanism or signal transmitter 23 of known construction. This mechanism 23 includes a spring actuated shaft 24 on which is mounted a detent disc 25 having a notch 26 to be engaged by the armature detent lever 20. The mechanism 23 also includes a disc 27 having a plurality of projections 28 thereon to cooperate with a spring switch contact 29 to oscillate the same into and out of engagement with another switch contact 30. The switch contacts 29 and 30 are connected in shunt with the coil 17 by the wires 31 and 32 and in circuit with a suitable signal or signal-receiving apparatus 34 and a source of electricity 35. The signal-operating mechanism 23 is normally held against operation by the armature detent lever 20 which is held in the notch 26 by a tension spring 36.

In operation, current normally flows from the source 35 through the wire 19, the tubing sections 2, and the thermo-responsive circuit changing mechanism 15, the coil 17 being of high resistance so that the current is shunted around the coil. Upon a variation in the circuit by operation or by opening of the thermo-responsive circuit changing mechanism 15 or a break in the tubing, the current is caused to flow through the electromagnetic coil 17 which is thereby energized and actuates the armature detent lever 20 out of the notch 26. Thereupon the signal-operating mechanism 23 is actuated to successively make and break the circuit through the contacts 29 and 30 and operate the signal or signal-receiving apparatus 34 in the usual manner. This signal or signal-receiving apparatus 34 may be what is sometimes termed "the signal receiver" of the apparatus commonly used in central stations. The projections 28 provide a certain signal and correspond to a certain local station, for example, a particular building or room, and each local station has a different number and arrangement of projections 28 in its corresponding signal-operating mechanism.

From the foregoing it will be observed that the signal-initiating devices 5 will be operated by fluid pressure generated in the tubing by a fire which heats any part of the length of the tubing and may serve as a local signal to operate at a low predetermined temperature, for example as would be incident to a small fire of short duration. The thermo-responsive circuit changing mechanism 15 may be operated at higher predetermined temperatures, for example, when a fire is large or of long duration, and cause actuation

of the signal or signal-receiving apparatus 34 which may be remote from the source of fire, for example, at a central station. Both the fluid pressure conduit and the electrical circuit through the tubing are under constant supervision since a break in the tubing will cause operation of the signal or signal-receiving apparatus 34.

Figure 2 shows a construction in general similar to that shown in Figure 1, the main difference being that the fluid actuated signal-initiating devices 37 are electrically connected to the tubing sections and carry switch contacts 38 which cooperate with other contacts 39 connected in circuit with the signal actuating mechanism.

The contacts 38 correspond to the ends of the tubing in the form of the invention shown in Figure 1. One contact 39 is connected to one of the terminals of the relay coil 17, while the other contact 39 is connected to the opposite terminal of the relay coil, through the respective wires 18 and 19. The contacts 29, 30, the signal or signal-receiving device 34, and the source of electricity, are connected in shunt relation with the coil 17 exactly as shown in Figure 1.

In operation, the signal actuating apparatus is controlled by both the fluid pressure signal-initiating device and the thermo-responsive circuit changing mechanism 15. The contacts 38, 39 are normally closed and a major portion of the electric current passes around the relay coil 17. Upon an increase in pressure in the fluid conduit, one or both of the contacts 38, 39 is opened which causes the current to pass through the coil 17 and set into operation the signal operating mechanism as described in connection with Figure 1. Upon an operation of thermo-responsive circuit changing mechanism 15 or upon a break in the tubing, the contacts 38, 39 remain closed, but the current passes through the relay coil 17, so as to cause operation of the signal operating mechanism. The tubing and the electric circuit therethrough including switch contacts 38, 39 are under constant electrical supervision.

In Figures 6 and 7 of the drawing, I have shown an electrically supervised fluid pressure fire alarm system which includes a fluid conduit 40 formed of electricity conducting tubing 41 enclosed or sheathed in electrical insulating material 42. The signal-initiating devices 43 and the signal actuating mechanism 44 are shown as identical with the devices 5 and the signal actuating mechanism 6—9 of the form of the invention shown in Figure 1.

A relay coil 45 is electrically connected in series with the tubing 41 and a source of electricity 46 by wires 47 and 48. The relay coil controls a switch 49 which is in circuit with a signal 50 and the source 46. The current from the source 46 normally passes through the tubing, and the relay coil 45 so as to energize the latter, which holds the switch normally open. Should a break in the tubing or wiring occur, the circuit through the relay will be interrupted, whereupon the switch 49 will be closed so as to operate the signal 50 and indicate that the tubing or wiring has been broken.

As will readily appear to those skilled in the art, any known mechanism for detecting grounding of an electric circuit, may be utilized to indicate if and when the tubing of the fluid conduit is grounded.

In Figure 8 of the drawing, I have shown another modification of the invention wherein a resistor 51 is connected in parallel circuit with each unit of the thermo-responsive circuit changing mechanism 15. This resistor may be a simple resistance coil, signal bell, incandescent lamp or the like. Preferably the resistor has such a resistance value that the major portion of the current will pass normally through the switch, and the resistor is so related to the thermo-responsive circuit changing mechanism and the trip coil 17 that when the switch is operated or opened by a rise in temperature, as by a fire, the current is caused to pass through the resistor whereby resistance in the circuit is changed so that the trip coil 17 is energized to cause operation of the signal actuating mechanism 23. Where the resistor 51 is in the form of a signal, such as an incandescent lamp, the signal or lamp will be operated so as to indicate that the thermo-responsive circuit changing mechanism has been operated, whereby the location of the thermo-responsive circuit changing mechanism which has been operated, as well as the location of the fire which has caused operation of the system, can be easily and quickly ascertained.

Obviously the details of construction of the fire alarm system may be widely modified and changed without departing from the spirit or scope of the invention. Also, many different types of fluid pressure signal-initiating devices, thermo-responsive circuit changing mechanism, and signal actuating mechanisms, may be used and connected in electrical circuits in various ways within the scope of the invention. The forms of the invention illustrated and described, while now preferred, are primarily for illustrating the principles of the invention.

Having thus described my invention, what I claim is:

1. A fire alarm system comprising a loop of electrically conducting "rate-of-rise" fire detecting tubing, said loop comprising relatively insulated sections interconnected through "fixed temperature" fire detecting circuit changing mechanism, said fixed temperature circuit changing mechanism being located at said tubing in position for subjection to the same abnormal temperature condition as said tubing, signal manifesting mechanism comprising a signal transmitter involving means for initiating the activity thereof responsive to impairment of the current path which includes said loop, a signal receiver responsive to activity of said transmitter, a second circuit changing mechanism connected for response to pressure in said tubing resultant from a predetermined rate of increase in the temperature of the atmosphere surrounding any portion of said tubing, and means whereby a signal may be initiated by said second mechanism while said receiver is responsive only to control by said transmitter and said transmitter is always responsive to impairment of the current path which includes said loop.

2. In a fire alarm system, in combination, a channel for fluid and a normally closed path for electricity which channel and path extend throughout the area to be protected and comprise a plurality of sections of metallic fire detecting tubing containing a fluid characterized by expansibility responsive to temperature rise such as will displace the fluid along the length of said channel, a hollow member of dielectric material providing a fluid chamber extending said channel between adjacent ends of said sections, a "fixed temperature" mechanism mounted on

said hollow member extending said path between adjacent ends of said sections and responsive to attainment of a predetermined temperature for impairing the conductivity of said path, electrical insulation enclosing said tubing, signaling mechanism comprising signal-initiating mechanism and a starting magnet therefor, said path forming part of a normally closed shunt around said magnet, means associated with said tubing for actuation by fluid pressure resultant from a predetermined rate-of-rise in the temperature of the atmosphere surrounding any portion of said tubing for impairing the conductivity of said shunt, and signal manifesting mechanism responsively associated with said signal-initiating mechanism.

3. In a fire alarm system, in combination, a channel for fluid and a normally closed path for electricity which channel and path extend throughout the area to be protected and comprise a plurality of sections of metallic fire detecting tubing containing a fluid characterized by expansibility responsive to temperature rise such as will displace the fluid along the length of said channel, a hollow member of dielectric material providing a fluid chamber extending said channel between adjacent ends of said sections, a "fixed temperature" mechanism mounted on said hollow member extending said path between adjacent ends of said sections and responsive to attainment of a predetermined temperature for impairing the conductivity of said path, signaling mechanism comprising signal-initiating mechanism and a starting magnet therefor, said path forming part of a normally closed shunt around said magnet, means associated with said tubing for actuation by fluid pressure resultant from a predetermined rate-of-rise in the temperature of the atmosphere surrounding any portion of said tubing for impairing the conductivity of said shunt, and signal manifesting mechanism responsively associated with said signal-initiating mechanism.

4. In a fire alarm system, in combination, a channel for fluid and a normally closed path for electricity which channel and path extend throughout the area to be protected and comprise a plurality of sections of metallic fire detecting tubing containing a fluid characterized by expansibility responsive to temperature rise such as will displace the fluid along the length of said channel, a member of dielectric material extending said channel between adjacent ends of said sections, a "fixed temperature" mechanism mounted on said member extending said path between adjacent ends of said sections and responsive to attainment of a predetermined temperature for impairing the conductivity of said path, signaling mechanism comprising signal-initiating mechanism and a starting magnet therefor, said path forming part of a normally closed shunt around said magnet, means associated with said tubing for actuation by fluid pressure resultant from a predetermined rate-of-rise in the temperature of the atmosphere surrounding any portion of said tubing for impairing the conductivity of said shunt, and signal manifesting mechanism responsively associated with said signal-initiating mechanism.

5. In a fire alarm system, in combination, a channel for fluid and a normally closed path for electricity which channel and path extend throughout the area to be protected and comprise a plurality of sections of metallic fire detecting tubing containing a fluid characterized by expansibility responsive to temperature rise such as will displace the fluid along the length of said channel, a member of dielectric material extending said channel between adjacent ends of said sections, a "fixed temperature" mechanism mounted on said member extending said path between adjacent ends of said sections and responsive to attainment of a predetermined temperature for impairing the conductivity of said path, signaling mechanism comprising signal-initiating mechanism and a starting magnet therefor, said path forming part of a normally closed shunt around said magnet, and means associated with said tubing for actuation by fluid pressure resultant from a predetermined rate-of-rise in the temperature of the atmosphere surrounding any portion of said tubing for impairing the conductivity of said shunt.

6. In a fire alarm system, in combination, a channel for fluid and a normally closed path for electricity which channel and path extend throughout the area to be protected and comprise a plurality of sections of metallic fire detecting tubing containing a fluid characterized by expansibility responsive to temperature rise such as will displace the fluid along the length of said channel, a member of dielectric material extending said channel between adjacent ends of said sections, a "fixed temperature" mechanism extending said path between adjacent ends of said sections and responsive to attainment of a predetermined temperature for impairing the conductivity of said path, signaling mechanism comprising signal-initiating mechanism and a starting magnet therefor, said path forming part of a normally closed shunt around said magnet, and means associated with said tubing for actuation by fluid pressure resultant from a predetermined rate-of-rise in the temperature of the atmosphere surrounding any portion of said tubing for impairing the conductivity of said shunt.

7. In a fire alarm system, in combination, a channel for fluid and a normally closed path for electricity which channel and path extend throughout the area to be protected and comprise a plurality of sections of metallic fire detecting tubing containing a fluid characterized by expansibility responsive to temperature rise such as will displace the fluid along the length of said channel, a hollow member of dielectric material providing a fluid chamber extending said channel between adjacent ends of said sections, a "fixed temperature" mechanism mounted on said hollow member extending said path between adjacent ends of said sections and responsive to attainment of a predetermined temperature for altering the conductivity of said path, electrical insulation enclosing said tubing, signal manifesting mechanism comprising means for response to alteration of the conductivity of said path, and independently acting means for response to fluid displacement in said channel resultant from a predetermined rate-of-rise of the temperature of the atmosphere surrounding any portion of said tubing.

8. In a fire alarm system, in combination, a channel for fluid and a normally closed path for electricity which channel and path extend throughout the area to be protected and comprise a plurality of sections of metallic fire detecting tubing containing a fluid characterized by expansibility responsive to temperature rise such as will displace the fluid along the length of said channel, a hollow member of dielectric material providing a fluid chamber extending said channel between adjacent ends of said sections, a "fixed temperature" mechanism mounted on said hol-

low member extending said path between adjacent ends of said sections and responsive to attainment of a predetermined temperature for altering the conductivity of said path, signal manifesting mechanism comprising means for response to alteration of the conductivity of said path, and independently acting means for response to fluid displacement in said channel resultant from a predetermined rate-of-rise of the temperature of the atmosphere surrounding any portion of said tubing.

9. In a fire alarm system, in combination, a channel for fluid and a normally closed path for electricity which channel and path extend throughout the area to be protected and comprise a plurality of sections of metallic fire detecting tubing containing a fluid characterized by expansibility responsive to temperature rise such as will displace the fluid along the length of said channel, a member of dielectric material extending said channel between adjacent ends of said sections, a "fixed temperature" mechanism mounted on said member extending said path between adjacent ends of said sections and responsive to attainment of a predetermined temperature for altering the conductivity of said path, signal manifesting mechanism comprising means for response to alteration of the conductivity of said path, and independently acting means for response to fluid displacement in said channel resultant from a predetermined rate-of-rise of the temperature of the atmosphere surrounding any portion of said tubing.

10. In a fire alarm system, in combination, a channel for fluid and a normally closed path for electricity which channel and path extend throughout the area to be protected and comprise a plurality of sections of metallic fire detecting tubing containing a fluid characterized by expansibility responsive to temperature rise such as will displace the fluid along the length of said channel, a member of dielectric material extending said channel between adjacent ends of said sections, a "fixed temperature" mechanism extending said path between adjacent ends of said sections and responsive to attainment of a predetermined temperature for altering the conductivity of said path, signal manifesting mechanism comprising means for response to alteration of the conductivity of said path, and independently acting means for response to fluid displacement in said channel resultant from a predetermined rate-of-rise of the temperature of the atmosphere surrounding any portion of said tubing.

11. In a fire alarm system, in combination, a channel for fluid and a normally closed path for electricity which channel and path extend throughout the area to be protected and comprise a plurality of sections of metallic fire detecting tubing containing a fluid characterized by expansibility responsive to temperature rise such as will displace the fluid along the length of said channel, a hollow member of dielectric material providing a fluid chamber extending said channel between adjacent ends of said sections, a "fixed temperature" mechanism mounted on said hollow member extending said path between adjacent ends of said sections and responsive to attainment of a predetermined temperature for altering the conductivity of said path, electrical insulation enclosing said tubing, and signal manifesting mechanism comprising means for response both to alteration of the conductivity of said path and to fluid displacement in said channel resultant from a predetermined rate-of-rise of the temperature of the atmosphere surrounding any portion of said tubing.

12. In a fire alarm system, in combination, a channel for fluid and a normally closed path for electricity which channel and path extend throughout the area to be protected and comprise a plurality of sections of metallic fire detecting tubing containing a fluid characterized by expansibility responsive to temperature rise such as will displace the fluid along the length of said channel, a hollow member of dielectric material providing a fluid chamber extending said channel between adjacent ends of said sections, a "fixed temperature" mechanism mounted on said hollow member extending said path between adjacent ends of said sections and responsive to attainment of a predetermined temperature for altering the conductivity of said path, and signal manifesting mechanism comprising means for response both to alteration of the conductivity of said path and to fluid displacement in said channel resultant from a predetermined rate-of-rise of the temperature of the atmosphere surrounding any portion of said tubing.

13. In a fire alarm system, in combination, a channel for fluid and a normally closed path for electricity which channel and path extend throughout the area to be protected and comprise a plurality of sections of metallic fire detecting tubing containing a fluid characterized by expansibility responsive to temperature rise such as will displace the fluid along the length of said channel, a member of dielectric material extending said channel between adjacent ends of said sections, a "fixed temperature" mechanism mounted on said member extending said path between adjacent ends of said sections and responsive to attainment of a predetermined temperature for altering the conductivity of said path, and signal manifesting mechanism comprising means for response both to alteration of the conductivity of said path and to fluid displacement in said channel resultant from a predetermined rate-of-rise of the temperature of the atmosphere surrounding any portion of said tubing.

14. In a fire alarm system, in combination, a channel for fluid and a normally closed path for electricity which channel and path extend throughout the area to be protected and comprise a plurality of sections of metallic fire detecting tubing containing a fluid characterized by expansibility responsive to temperature rise such as will displace the fluid along the length of said channel, a member of dielectric material extending said channel between adjacent ends of said sections, a "fixed temperature" mechanism extending said path between adjacent ends of said sections and responsive to attainment of a predetermined temperature for altering the conductivity of said path, and signal manifesting mechanism comprising means for response both to alteration of the conductivity of said path and to fluid displacement in said channel resultant from a predetermined rate-of-rise of the temperature of the atmosphere surrounding any portion of said tubing.

15. In a fire alarm system, in combination, a conduit for fluid and a normally closed path for electricity which conduit and path extend throughout the area to be protected and comprise a plurality of sections of metallic fire detecting tubing connected together with their ends in electrically insulated relation to form a con-

tinuous conduit for fluid, said conduit containing a fluid characterized by expansibility responsive to temperature rise such as will displace the fluid along the length of said conduit, "fixed temperature" mechanisms electrically connecting adjacent ends of said sections for normally establishing a current path through and between adjacent sections and responsive to attainment of a predetermined temperature for altering the conductivity of said path, electrical insulation enclosing said tubing, signal manifesting mechanism comprising means for response both to alteration of the conductivity of said path and to fluid displacement in said conduit resultant from a predetermined rate-of-rise of the temperature of the atmosphere surrounding any portion of said tubing.

16. In a fire alarm system, in combination, a conduit for fluid and a normally closed path for electricity which conduit and path extend throughout the area to be protected and comprise a plurality of sections of metallic fire detecting tubing connected together with their ends in electrically insulated relation to form a continuous conduit for fluid, said conduit containing a fluid characterized by expansibility responsive to temperature rise such as will displace the fluid along the length of said conduit, "fixed temperature" mechanisms electrically connecting adjacent ends of said sections for normally establishing a current path through and between adjacent sections and responsive to attainment of a predetermined temperature for altering the conductivity of said path, and signal manifesting mechanism comprising means for response both to alteration of the conductivity of said path and to fluid displacement in said conduit resultant from a predetermined rate-of-rise of the temperature of the atmosphere surrounding any portion of said tubing.

17. In a fire alarm system, means for manifesting signals responsive both to the attainment of predetermined temperature and to more than a predetermined rate of temperature rise, said means comprising "fixed temperature" mechanism for altering the conductivity of a normally closed circuit responsive to attainment of a predetermined temperature, and "rate-of-rise" fire detecting mechanism including tubing, which tubing serves as an electrical conductor between said circuit altering mechanism and said signal manifesting means, and electrical insulation enclosing said tubing.

18. In a fire alarm system, means for manifesting signals responsive both to the attainment of predetermined temperature and to more than a predetermined rate of temperature rise, said means comprising "fixed temperature" mechanism for altering the conductivity of a normally closed circuit responsive to attainment of a predetermined temperature, and "rate-of-rise" fire detecting mechanism including tubing, which tubing serves as an electrical conductor between said circuit altering mechanism and said signal manifesting means.

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