Nov. 2, 1948. K. M. LORD ET AL 2,452,942

TEMPERATURE ALARM SYSTEM

Filed Feb. 26, 1945 4 Sheets-Sheet 1

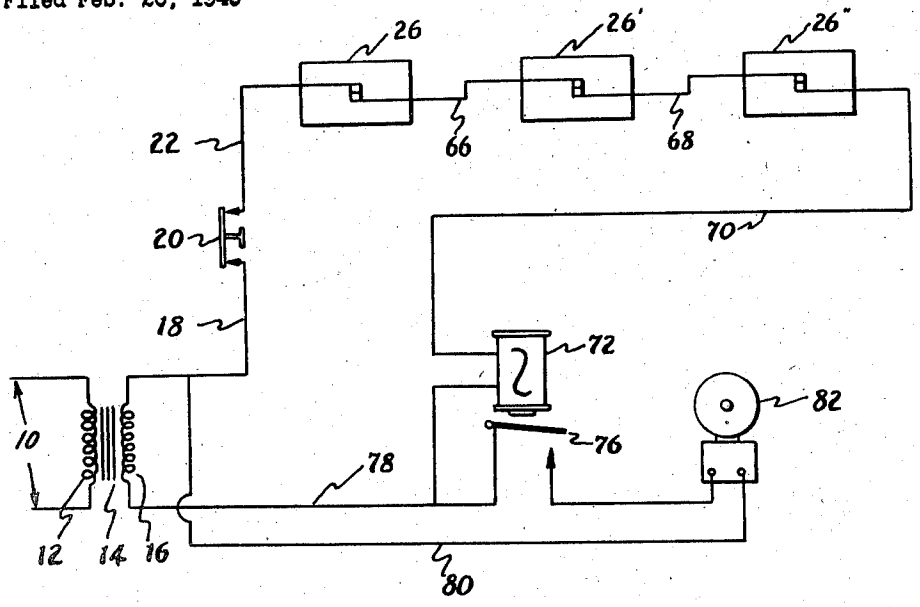


Fig. 1.

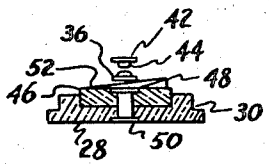


Fig. 3.

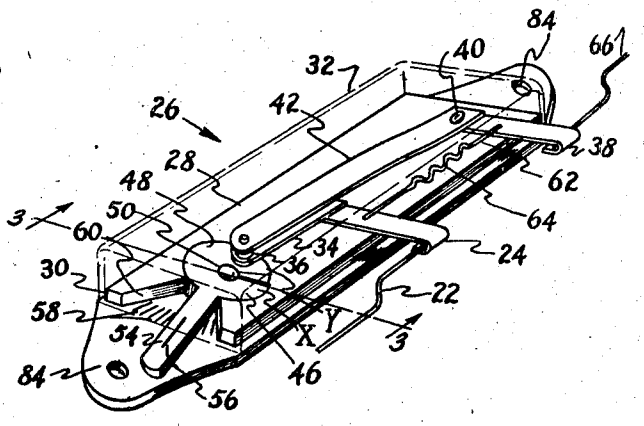


Fig. 2.

KENNETH M. LORD.
GLENN E. WARREN. INVENTORS.

BY their attorney
Carl J. Barbee

Nov. 2, 1948. K. M. LORD ET AL 2,452,942

TEMPERATURE ALARM SYSTEM

Filed Feb. 26, 1945 4 Sheets-Sheet 2

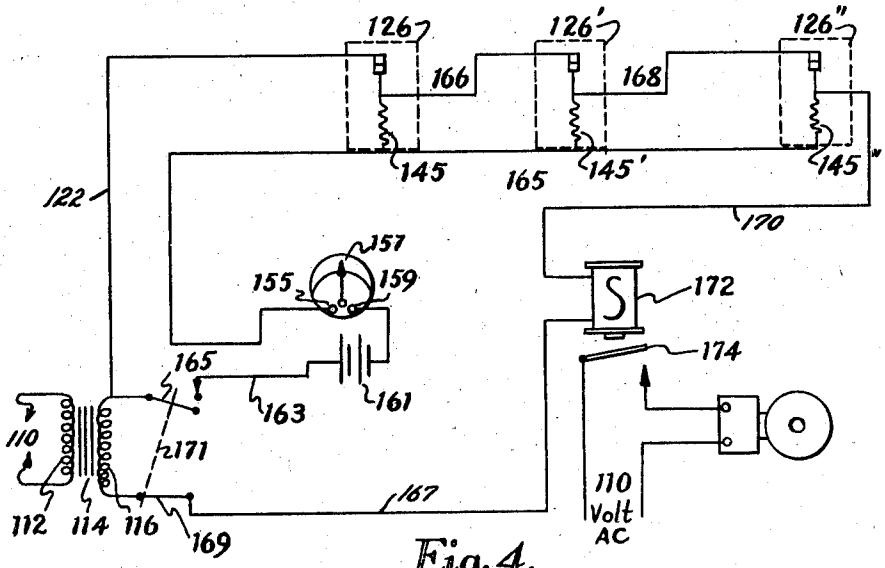


Fig. 4.

Fig. 5.

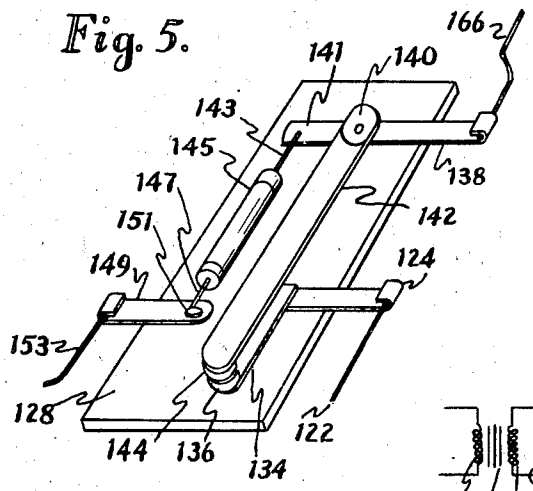
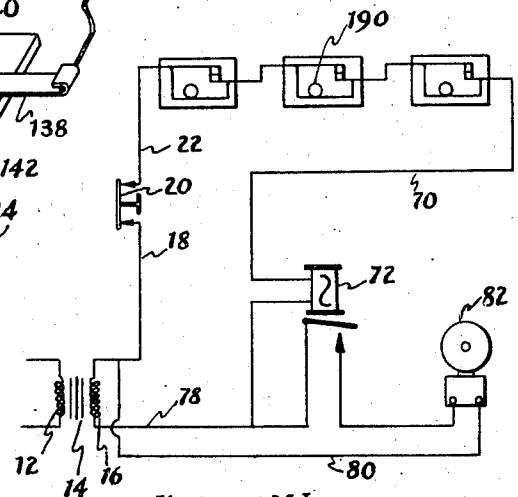


Fig. 6.



KENNETH M. LORD
GLENN E. WARREN INVENTORS

BY their attorney
Carl J. Barbee

Nov. 2, 1948. K. M. LORD ET AL 2,452,942

TEMPERATURE ALARM SYSTEM

Filed Feb. 26, 1945 4 Sheets-Sheet 3

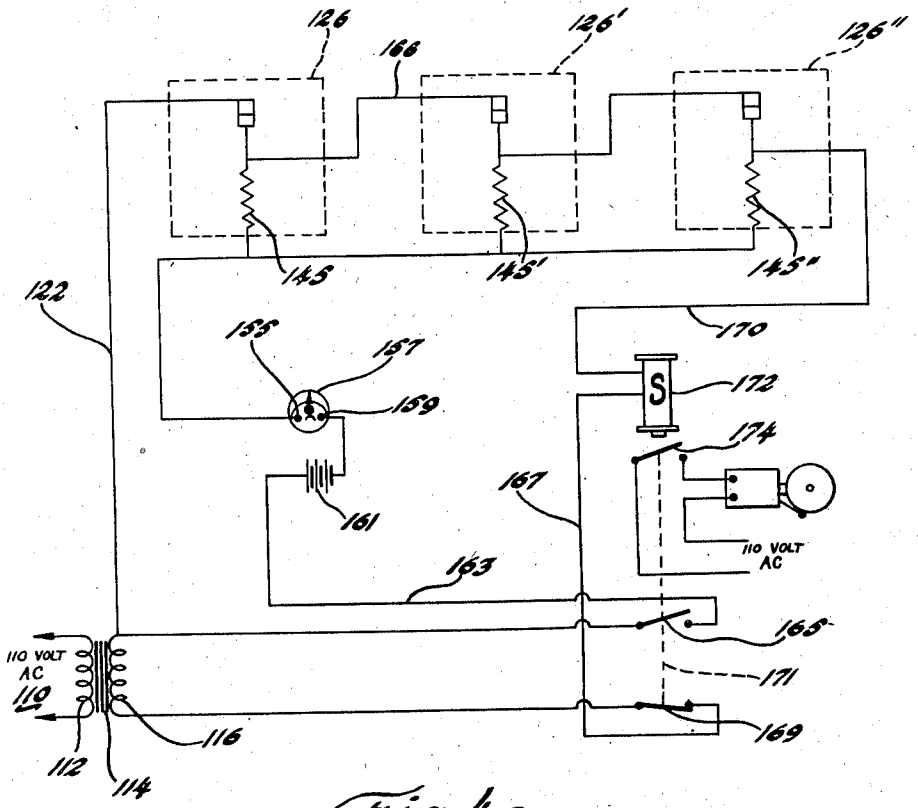


Fig. 4a

KENNETH M. LORD
GLENN E. WARREN
INVENTORS

BY Albert Latta
THEIR ATTORNEY

Nov. 2, 1948. K. M. LORD ET AL 2,452,942

TEMPERATURE ALARM SYSTEM

Filed Feb. 26, 1945 4 Sheets-Sheet 4

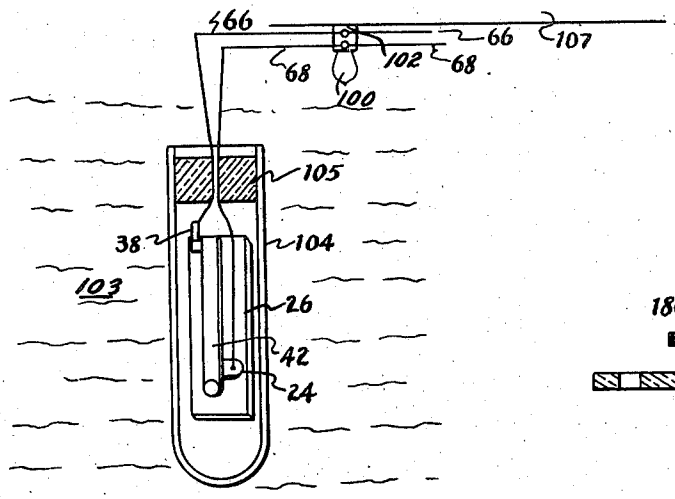


Fig. 7.

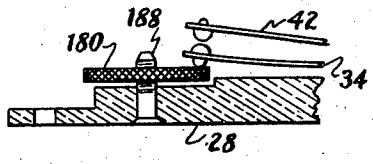


Fig. 8.

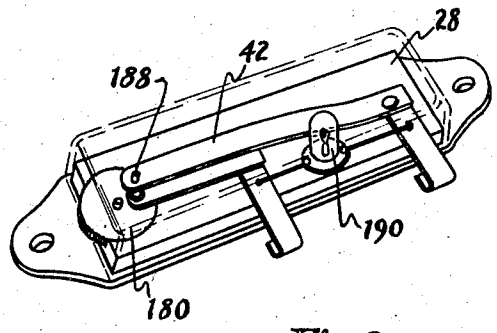


Fig. 9.

KENNETH M. LORD
GLENN E. WARREN INVENTORS

BY his attorney
Carl J. Barbee

Patented Nov. 2, 1948 2,452,942

UNITED STATES PATENT OFFICE

2,452,942

TEMPERATURE ALARM SYSTEM

Kenneth M. Lord, Canandaigua, and Glenn E. Warren, Honeoye Falls, N. Y., assignors to Protect-O-Farm Company, Kenosha, Wis., a partnership

Application February 26, 1945, Serial No. 579,740

5 Claims. (Cl. 177—311)

1

This invention relates to alarm systems and is more particularly concerned with systems in which it is desired to transmit a signal to a central point indicating danger due to a change in temperature. The system is primarily designed as a fire alarm signaling system although it may be modified so that one or more stations are established to be tripped by a temperature reaching so low a point as to be considered hazardously close to freezing.

Automatic fire alarm systems for industrial plants have been upon the market for many years but the cost has been considered excessive for the amount of protection afforded except where the manufacturing hazard is extremely great as in the case of a combustible product such as explosives. A very large market exists for an alarm system of this character where the location of a fire or dangerous heat condition can be rapidly ascertained after the sounding of the alarm. The broad principles of the system may also be applied to a simplified adaptation which would be useful to farmers, garages, small industrial shops or lofts and the like.

With these considerations in view, it is an object of this invention to provide an alarm system which is simple to install and operate, will require little or no maintenance and which may be periodically tested for operativeness with a minimum of trouble.

A further object of the invention is to provide a detecting unit which is highly portable, may easily be secured in place at a station where danger of fire or freezing temperatures exists and which may be manufactured cheaply and economically.

It is a further object of this invention to provide a detecting unit which may be adjusted to trip at any predetermined temperature within a range of temperatures.

An additional object of the invention is to provide a temperature detecting system employing a simple electrical circuit which is established and maintained through a series of temperature detecting units by means of a low voltage so that the system can be operated with wire of small size in order to reduce the cost of installation.

Further objects and advantages will appear hereinafter as the description proceeds and will be pointed out in connection with the appended claims.

In the drawings, of which there are three (3) sheets:

Figure 1 is a diagrammatic view showing one

2

modification of the system in its most simplified form;

Figure 2 is a perspective view of a temperature detecting unit as used in the circuit illustrated in Figure 1;

Figure 3 is a vertical transverse sectional view through the unit shown in Figure 2 and taken substantially upon a plane as indicated by the broken line 3—3 of Figure 2 and looking in the direction of the arrows;

Figure 4 is a diagrammatic view corresponding to Figure 1 but illustrating a modified type of circuit for more elaborate installations;

Figure 5 is a perspective view corresponding to Figure 2 but illustrating a temperature detecting unit for use in connection with the circuit illustrated in Figure 4;

Figure 6 is a diagrammatic view of a modified circuit in which a lamp bulb is employed in each detector unit;

Figure 7 is a sectional view of a detector unit buried in a mass of material;

Figure 8 is a partial sectional view through a modified form of detector unit; and,

Figure 9 is a perspective view of a detector unit employing a lamp bulb for use in the circuit shown in Figure 6.

Referring more specifically to the drawings in which similar parts are designated by the same reference characters and which are to be taken as illustrative rather than as limiting the invention, the system comprising the invention includes a power source 10 which may be the usual 110 volt alternating current power supply generally available in most homes, farms, and factories. Power from this source is led through the primary winding 12 of a transformer indicated generally at 14. The secondary winding 16 of transformer 14 is provided with sufficient turns to insure delivery of a potential of approximately 23 volts which is the functioning voltage of the alarm system.

Power from the secondary side 16 of the transformer 14 is passed through conductor 18 and normally closed switch 20 (the purpose of which will be hereinafter described) and thence through bell wire 22 to one terminal 24 (Figure 2) of a temperature detecting unit generally designated at 26. Detecting unit 26 consists of a base 28 peripherally shouldered as at 30 for the reception of a cap or cover illustrated at 32 in dotted lines. Cover 32 may be made from glass or clear plastic for a purpose to be later explained or could be a metal stamping.

Terminal 24 may be secured to the approxi-

mate center of base 28 by means of a rivet which also fastens in place a conductor 34 supporting one contact 36 of a temperature actuated device. A second terminal 38 is secured to one end of base 28 by means of a rivet 40 which also serves to anchor one end of a bi-metallic temperature responsive strip 42 upon base 28. The bi-metallic element 42 supports on its free end a contact point 44 which is adapted normally to lie in contact with contact point 36 upon conductor 34.

The free or unsecured end of conductor 34 overlies and is supported from a circular plate 46 of plastic or insulating material received in a circular aperture 48 provided in the upper surface of base 28. A rivet 50 extends loosely through plate 46 and base 28 to serve as a bearing for relative rotation between plate 46 and base 28. The upper surface of plate 46 is contoured to provide a cam surface 52 which rises from a low point X evenly and smoothly to a high point Y. The plate 46 is provided with an extension 54 serving as a handle for rotating plate 46 about the axis of rivet 50 to raise or lower the bottom, or relatively fixed, contact 36. The outer end of handle 54 may be provided with a bench mark 56 and the surface of shoulder 30 may have graduations stamped thereupon as at 58 to indicate the extent of the adjustment. Handle 54 extends outside of base 28 through an arcuate notch 60.

An alternative method of adjustment involves the support of the free end of conductor 34 upon the upper surface of a knurled edge plate 180 which plate may in turn be internally threaded to co-act with a threaded post 188 supported from base 28 as in Figure 8.

In the normal unit the bi-metallic element 42 is so shaped and proportioned that when the lower contact support arm 36 lies upon that portion of the cam plate indicated at X the contact points will remain in circuit establishing position at all temperatures up to 180° F. Rotation of the cam plate 46 counter-clockwise as viewed in Figure 2 results in movement of the lower contact 36 upwardly and a consequent raising of the separating temperature of contacts 44 and 36. In the modification shown in Figure 8, raising the plate 180 by threading it upwardly upon post 188 will similarly raise the temperature of release of the bi-metallic element 42.

Bi-metallic element 42 may also be reversed so as to provide for maintenance of contacts 36 and 44 in circuit establishing relationship at all temperatures above a predetermined minimum, say 32° F. The separation temperature of such a unit could also be controllably varied.

While not a necessary adjunct to the operation of the system, a convenience measure includes an extremely high resistance wire 62 of very small size which may be soldered across the terminals 24 and 38. A central portion of wire 62 indicated by zig-zag lines in Figure 2 may be secured to the upper surface of base 28 by a paste (in which a combustible smudge forming element is mixed). With contacts 36 and 44 in normally closed position, the current flowing through the device passes through these contacts; when, however, the contacts are opened by a temperature change the entire current must pass through the extremely high resistance of wire 64 which rapidly heats up to incandescence igniting the combustible element in the paste and blackening or smudging the interior of the glass or clear plastic cover to serve as a tell-tale that the temperature of the station protected by this particular device has reached a danger point. The resistance wire

rapidly burns out and the circuit is disconnected for a purpose as will soon appear.

Another form of tell-tale device which might be employed would involve the use of an incandescent bulb 190 in place of the high resistance wire, as shown in Figure 9, so selected as to cause a substantial variation in the circuit current when the contacts 36 and 44 are opened. The illumination from the incandescent lamp 190 in this form serves to indicate which detector has reached a danger point. Also, when using a lamp, replacement of the detector unit after each circuit interruption would not be necessary.

In the event a lamp bulb 190 is used in place of a self-destroying wire, it is contemplated that the lamp will be connected across the terminals as shown in Figure 6 and will provide so high a resistance as to cause a reduction in the circuit current to so great an extent that insufficient current will flow to maintain the relay in its raised position; thus closing switch 76 and energizing bell circuit 78, 80 and 82.

Continuing with the electrical system illustrated in Figure 1, a conductor 66 connects the unit 26 in series to a second unit 26' and a third unit 26'' is connected in series by conductor 68 to second unit 26'. As many units 26, 26', 26'', etc., as may be desired are thus connected in series and the final unit in the series is connected by means of a conductor 70 through the winding of a solenoid or relay 72 to the secondary 16 of transformer 14. Relay 72 functions in its normally energized condition to maintain switch 76 in open position.

Switch 76 is inserted in a circuit including conductors 78 and 80 for establishing an electrical circuit to a bell 82.

It will thus be seen that while the circuit through the units 26, 26', 26'', etc., remains established the bell circuit is open because of relay 72 holding switch 76 open. When, however, the circuit through the temperature detecting units is broken as by separation of the contact points 36, 44, relay 72 is de-energized to close switch 76 to establish the bell circuit which audibly warns of a break in the circuit signifying that a danger-out temperature exists which warrants investigation. An inspection of the units can then be made for evidence of smudging or blackening or lighting of the incandescent bulbs.

A switch 20 in the form of a circuit-opening push button may be provided in the detector circuit for periodic testing by opening the detector circuit.

Referring briefly to Figure 2, the base 28 may be provided with ears 84 which are perforated to permit fastening the units by means of nails or other fasteners in locations considered dangerous from the standpoint of fire or freezing temperatures. It may be considered desirable not to secure the detecting unit 26 in place but simply to bury it as shown in Figure 7 in a mass of material 103 such as green or uncured hay, ensilage or other material, which might present a fire hazard as source of spontaneous combustion. In this connection the detector may be sealed inside an impervious case 104 of glass, metal or other suitable material closed by a plug 105 through which connectors 66' and 68' may pass, to prevent the entry of foreign matter. For detector units buried in a mass 103 a provision could be made to have the incandescent bulb 100 mounted in a visible location as on an external support 102 secured to a beam 107 as

shown in Figure 7 so that the visual recognition of the alarming detector would be facilitated.

Referring now to Figure 4 illustrating a slightly more elaborate system for signalling, the circuit will be seen to comprise a main power input 110 of 110 volts alternating current which passes through the primary coil 112 of a transformer 114. A secondary coil 116 of the transformer is arranged to provide a potential of approximately 23 volts upon which the detector circuit operates. A conductor 122 connects one end of secondary coil 116 to terminal 124 upon detector unit 126. Terminal 124 (see Figure 5) is connected to a support 134 for contact 136 which is adapted to co-act with contact 144 secured to the free end of bi-metallic element 142, the opposite end of which is anchored by rivet 140. Rivet 140 also functions to connect terminal 138 to bi-metallic element 142. Conductor 166 leading to the second detector unit 126' extends from the crimped end of terminal 138.

The terminal 138 is also extended beyond the rivet 140 as at 141 to provide a connection to which one terminal 143 of a resistance 145 may be secured as by soldering. The other terminal 147 of resistor 145 is secured to a terminal 149 attached by rivet 151 to base plate 128. A wire 153 serves as a conductor to connect the equivalent terminals 149 in each of detectors 126, 126', and 126'', etc., to a terminal of a milliammeter 157, the opposite terminal 159 of milliammeter 157 being connected to a constant voltage direct current source such as a battery 161. A conductor 163 connects the opposite side of battery 161 to a normally open single pole single throw switch 165, having its closed end connected to conductor 122 of detector circuit.

The balance of the detector circuit is similar to that illustrated in Figure 1 extending through conductor 170 to relay 172 for operating the bell circuit closing switch 174 (which in this instance is illustrated as operated from a 110 volt power source) and finally through conductor 167 to a normally closed single pole, single throw switch 169 which connects to secondary 116 to complete the circuit

Switch 169 is connected to switch 165 by means of a mechanical, non-electrical conducting link 171 in such a manner that when switch 165 is closed, switch 169 is opened and vice versa. The switches 165, 169 are shown arranged to be manually operated but could be actuated to close switch 165 and open switch 169 by the moving member of relay 172 when switch 174 is closed as shown in Figure 4a.

Assuming the system to be in operative condition as shown in Figure 4 and one of the detector stations 126 to be tripped as by excessive heat or cold, the detector circuit being thus opened will stop the flow of current to relay 172 closing switch 174 and energizing the bell or alarm circuit. The operator thereupon pushes the button to open switch 169 and close switch 165 to energize the milliammeter circuit (in the case of the manually operated detector system).

Since the resistances 145, 145', 145'', etc., are connected in the milliammeter circuit in parallel, and since the amount of resistance in the line is controlled by opening and closing of contacts 136 and 144 in each unit, 126, 126', 126'', etc., the resistance of the entire circuit with any one unit having its contacts open can readily be computed using the formula: $1/R=1/R'+1/R''+1/R'''$, etc.

Knowing the computed resistance (with constant voltage) with any one of detector resistances 145, 145', 145'', etc., eliminated, it will be an easy matter to calibrate the scale of the milliammeter in such a way as to indicate directly the station or stations from which the alarm is proceeding. For purposes of standardization and ease of installation the resistance inserted in the detectors may be equal. With equal resistances in each detector the division of a milliammeter scale, is equal.

Assuming in a three station circuit as shown in Figure 4 that resistance 145 is 1000 ohms, resistance 145' is 1000 ohms, and resistance 145'' is 1000 and that the voltage supplied is 6 volts from a standard dry cell. The voltage drop through the conductors will be negligible and the current flowing will be—

.0 ampere with station 126 open
.006 ampere with station 126' open
.012 ampere with station 126'' open

These positions can readily be marked on the dial of a milliammeter.

It might be desirable in some installations to have a resistor only every ten stations, for instance. In this manner the milliammeter reading would indicate that any one of a certain group of detector units was alarming, rather than indicating exactly which unit was alarming. By doing this many more detector units could be provided for on a single milliammeter scale.

While the invention is described in considerable detail, the foregoing description is to be taken as illustrative and not limiting. All equivalents falling within the scope of the appended claims are expressly included as a part of this invention.

We claim:

1. In a temperature signalling system comprising a signalling circuit, a central alarming station and a plurality of temperature detecting stations connected in series to establish a detector circuit, said detecting stations each including a normally-closed set of contacts, a normally open secondary indicating circuit paralleling said detector circuit including an ammeter and connected to said detector circuit through resistances at each of said detecting stations, means operated by the opening of said detecting circuit for establishing both said indicating and said signalling circuit for simultaneously disconnecting said detector circuit and establishing said indicating circuit through said resistances remaining when the contacts at one detector staton are open to affect said ammeter for indicating the station affected.

2. In a temperature signalling system for indicating at a central station the occurrence, at any one of a plurality of remote locations, of a predetermined temperature condition, the combination of an alarm mechanism at said central station including a relay, an alarm device, an energizing circuit for said alarm including a contact for said relay, and means operative upon release of said relay for placing said contact in closed position, a first source of current connected in series with said relay, a contact device at each location including a normally closed contact adapted to open upon occurrence of said predetermined temperature condition at its location and a permanent and constant connection from each location to circuits connecting said permanent connections parallel to each other across a switch, an ammeter and a second source of current of constant voltage, said closed con-

tacts being connected in series across said first source of current and relay to keep the latter normally energized, each of said circuits having a predetermined resistance different from those of all other parallel circuits, and means under the control of the operator for closing said ammeter switch and opening the series circuit through said locations and said first source of current.

3. In a temperature signalling system comprising a signalling circuit, a plurality of temperature detecting stations connected in series across a first source of power and through a relay to establish a detector circuit, said detecting stations each including normally closed contacts adapted to open upon occurrence of predetermined temperature condition, a normally open indicating circuit in parallel with said detector circuit having constant and direct connections through resistances to said detector circuit at regular intervals at said detecting stations, said indicating circuit including a second source of power, an ammeter and a switch, means including said relay operated by the opening of said detector circuit to simultaneously close the signalling circuit and close said switch of said indicating circuit and place it across said second source of power.

4. In a temperature signalling system comprising a signalling circuit, a plurality of temperature detecting stations connected in series across a first source of power and through a relay to establish a detector circuit, said detecting stations each including normally closed contacts adapted to open upon occurrence of a predetermined temperature condition, a normally open indicating circuit in parallel with said detector circuit but constantly and directly connected thereto at said detecting stations through equal resistances, said indicating circuit including a second source of power, an electrical measuring instrument and a switch, means including said relay operated by the opening of said detector circuit for establishing said signalling circuit,

and operator controlled means for closing said switch to establish said indicator circuit and disconnecting said detector circuit.

5. In a temperature signalling system comprising a signalling circuit, a plurality of temperature detecting stations connected in series across a source of power and through a relay to establish a detector circuit, said detecting stations each including normally closed contacts adapted to open upon occurrence of a predetermined temperature condition, a normally open indicating circuit in parallel with said detector circuit having constant and direct connections through resistances to said detector circuit at said stations, a switch for closing said indicating circuit, a second switch connected with said first switch and adapted to open said detector circuit when said indicating circuit is closed, said indicating circuit including an ammeter calibrated to indicate the point of interruption of said detector circuit, and means functioning upon interruption of said detector circuit to establish said signalling circuit.

KENNETH M. LORD.
GLENN E. WARREN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
645,588	Doddridge	Mar. 20, 1900
880,136	Gehrung	Feb. 25, 1908
1,224,385	Kennedy	May 1, 1917
2,339,436	Stephenson	Jan. 18, 1944
2,408,660	Lannge	Oct. 1, 1946

FOREIGN PATENTS

Number	Country	Date
13,647	Great Britain	1895
28,920	Great Britain	1904
436,755	Great Britain	Oct. 17, 1935