O. RENNERT.

CIRCUITS FOR AUTOMATIC FIRE INDICATORS.

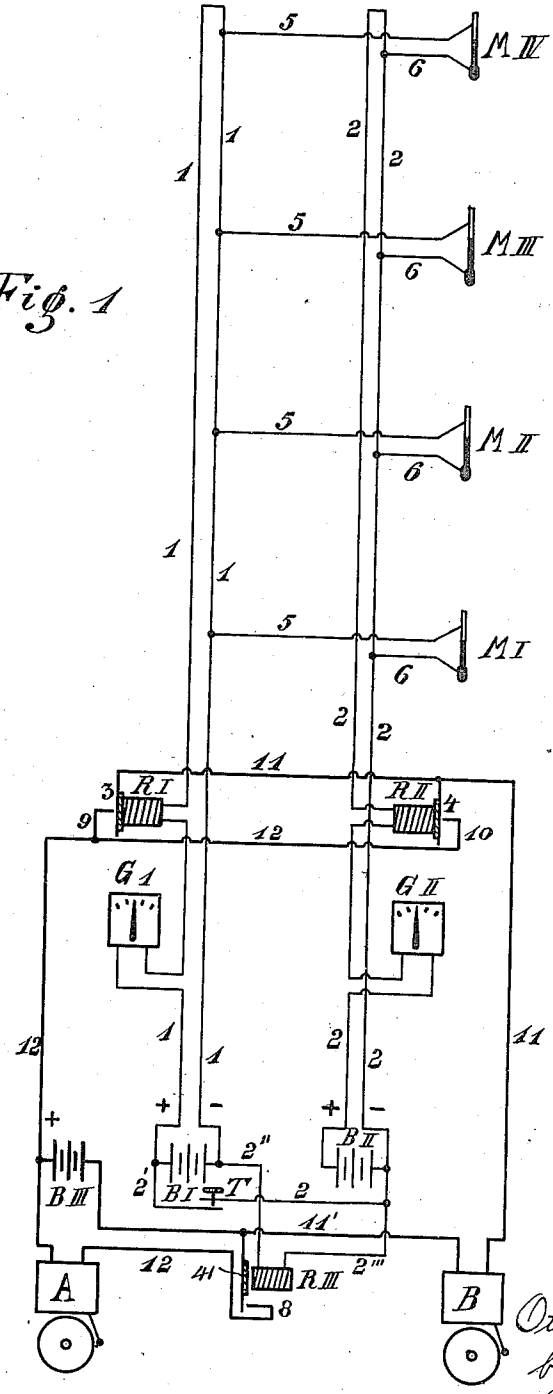
APPLICATION FILED MAY 22, 1911.

1,090,412.

Patented Mar. 17, 1914.

5 SHEETS—SHEET 1.

Fig. 1



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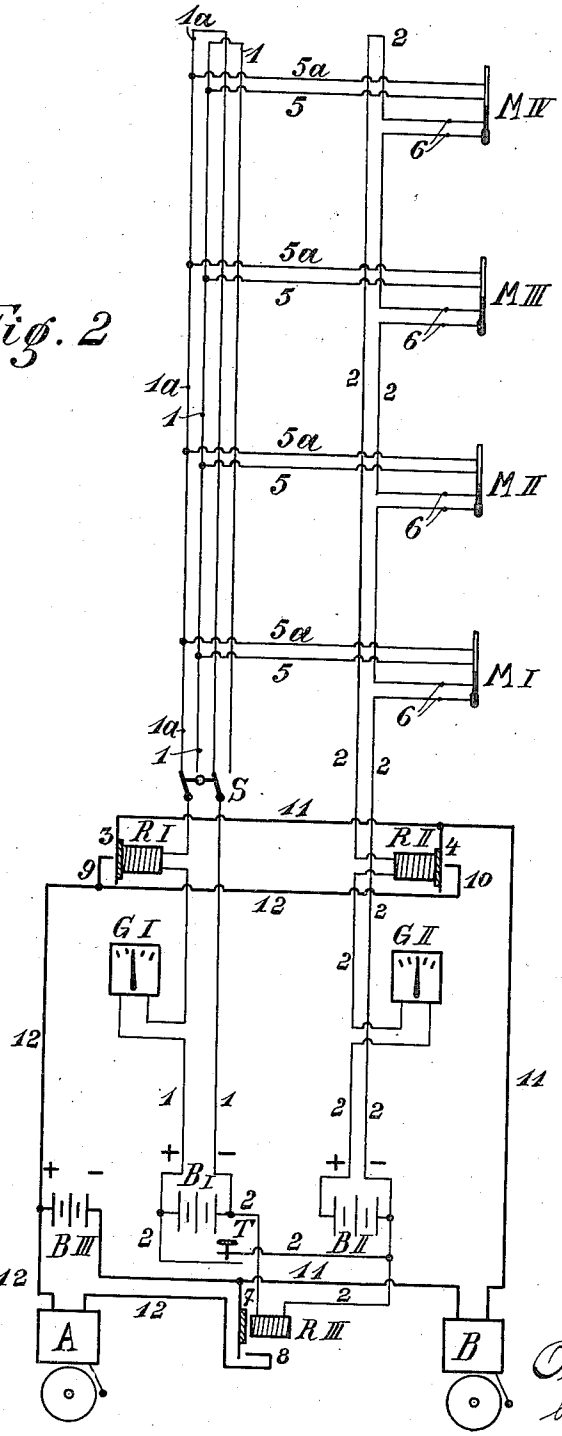
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5 SHEETS—SHEET 2.

Fig. 2



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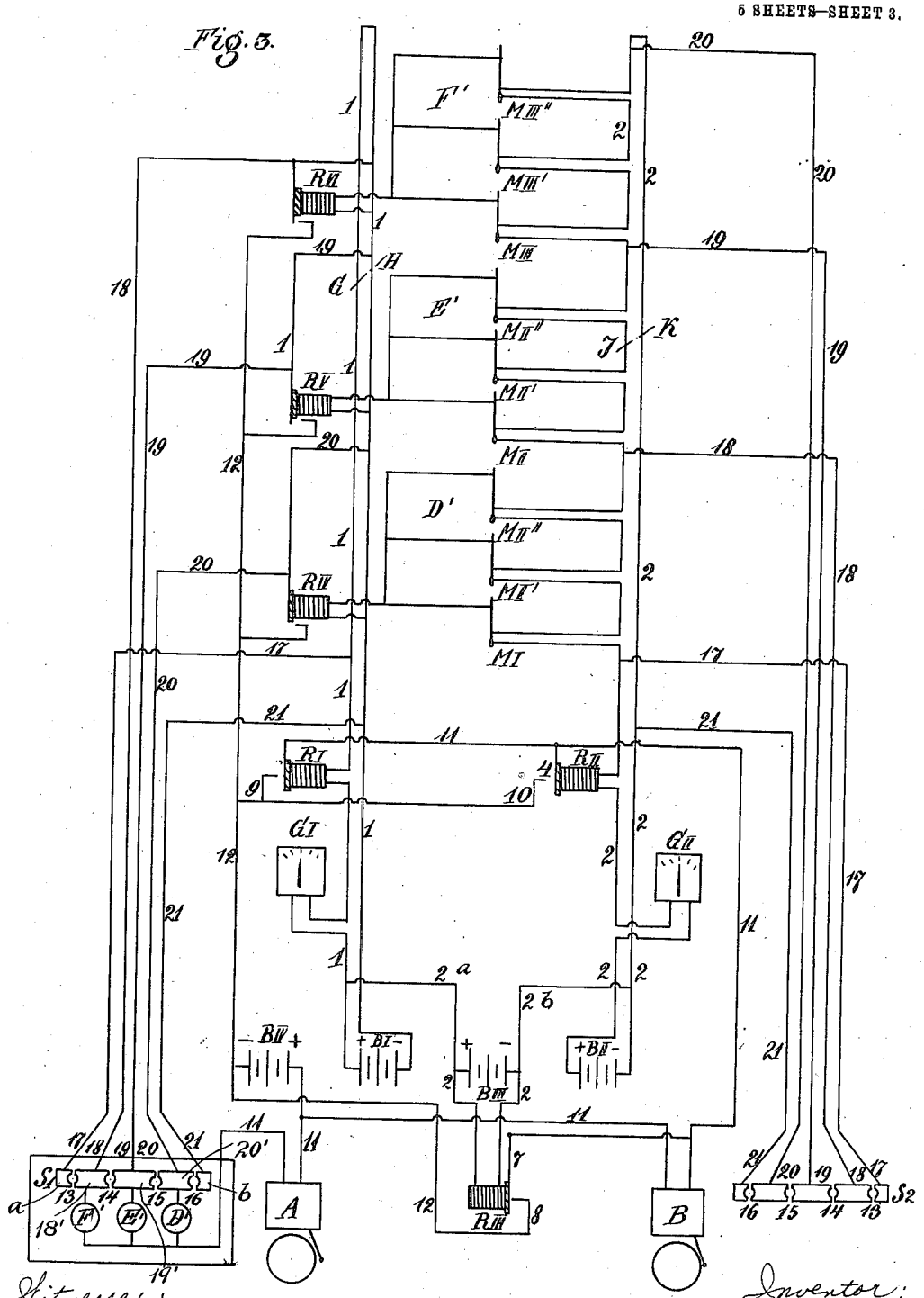
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5 SHEETS—SHEET 3.

Fig. 3.



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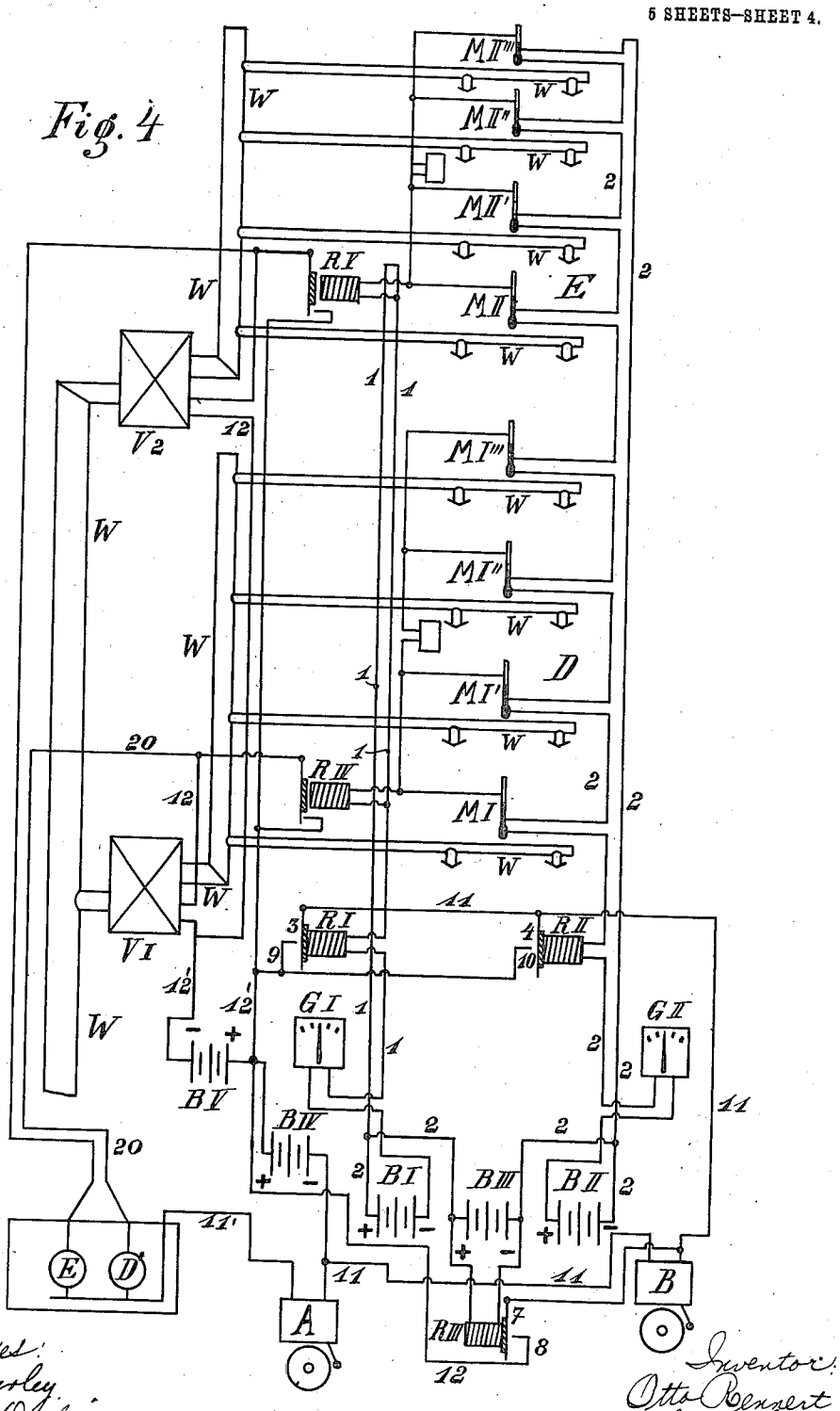
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5 SHEETS—SHEET 4.

Fig. 4



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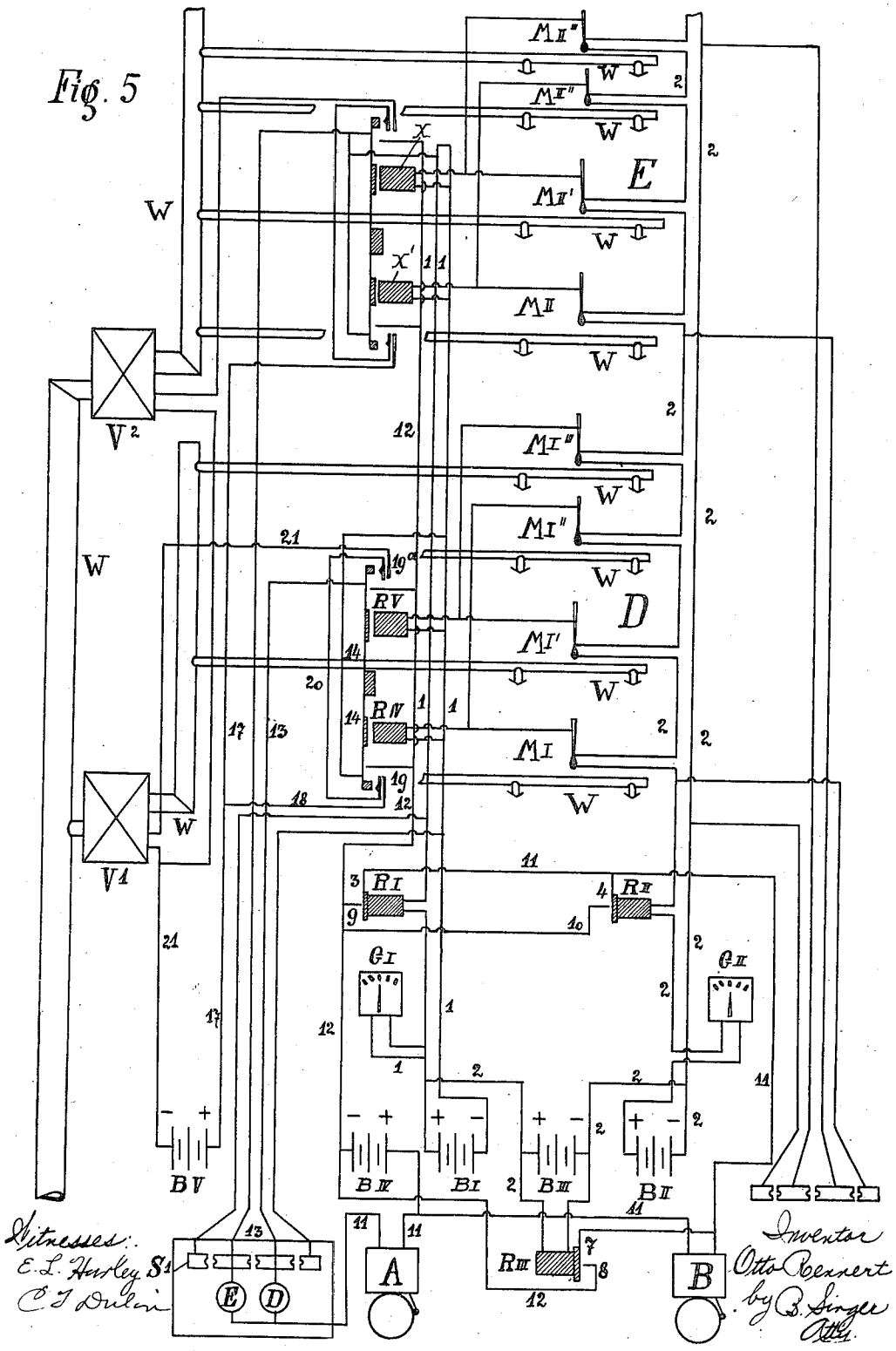
CIRCUITS FOR AUTOMATIC FIRE INDICATORS.

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5 SHEETS—SHEET 5.

Fig. 5



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UNITED STATES PATENT OFFICE.

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CIRCUITS FOR AUTOMATIC FIRE-INDICATORS.

1,090,412. Specification of Letters Patent. Patented Mar. 17, 1914.

Application filed May 22, 1911. Serial No. 628,716.

To all whom it may concern:

Be it known that I, OTTO RENNERT, citizen of Germany, residing at Munich, Bavaria, Germany, have invented certain new and useful Improvements in Circuits for Automatic Fire-Indicators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention relates to improvements in electrically operated fire alarm systems, or the like, and while pertaining to such systems, it is more particularly adapted for use in connection with fire extinguishing systems.

An object of the invention is to provide an alarm system of comparatively simple arrangement and one in which a positive actuation of the danger signals and extinguishing devices is obtained only when a predetermined operating condition is reached.

Another object of the invention is to provide a system which indicates careless or accidental closing of one of the several circuits comprising the system, but, at the same time, does not actuate the danger signals or extinguishing devices until the predetermined operating condition has been reached.

A further object of the invention is to provide means for restoring the entire system to its normal condition after a disturbance or operation of same.

With these and other objects in view, the invention comprises, primarily, a main controlling circuit consisting of a pair of looped conductors arranged, preferably, in parallel relation, each having connected in series therewith a source of current, a relay and a galvanoscope, the pointers of the latter being deflected and the armature of the relays being attracted if the system is in operative condition. Connected in parallel, between a branch of each of the looped conductors are a plurality of mercury circuit closers, or thermometers, which are adapted to be adjusted to any desired degree of temperature, and, when such degree of temperature is reached, complete the circuit through the looped conductors in a manner which will hereinafter be more fully described. Connected to the terminals of the relays of the looped conductors are the auxiliary circuits which are provided with a source of current and alarm devices of any suitable type. An indicating device, preferably a drop annunciator, is connected from one of its terminals to the main controlling circuits and by the other of its terminals to the auxiliary circuits, and is adapted to indicate a careless or accidental disturbance in the controlling circuit without the operation of the danger signals and fire extinguishing devices.

The invention will be hereinafter more particularly described with reference to the accompanying drawings forming a part of this specification and will then be pointed out in the appended claims and in which drawings:—

Figure 1 is a diagrammatical view of the invention in its simplest form. Fig. 2 is a diagrammatical view of a modified form of the invention, disclosing the adjustment of the system to operate at various degrees of temperature. Fig. 3 is a diagrammatical view of a modified form of the invention as disclosed in Fig. 1. Fig. 4 is a diagrammatical view, of a modified form of the invention, disclosing the alarm system operating in connection with fire extinguishing devices. Fig. 5 is a diagrammatical view, of a modified form of the invention, disclosing a safety connection to protect the device against illegitimate actuation.

Referring to Fig. 1 of the drawing: a pair of looped conductors 1—1 and 2—2 are arranged, preferably, in parallel relation with respect to each other and are connected to provide substantially a pair of closed series circuits, each circuit including respectively a source of current B_1, B_2, an auxiliary circuit controlling relay R_1, R_2, and a galvanoscope G_1, G_2. A plurality of thermal circuit closers or thermometers are arranged in parallel and are electrically connected by the conductors 5 to one side of the looped circuit 1—1 and by the conductors 6 to one side of the looped circuit 2—2. Should the circuits be in operative connection, the indicators of the galvanoscopes G_1, G_2, will be deflected and the armatures 3 and 4 of the relays R_1 and R_2, will be attracted. The armature 3, of the relay R_1, is connected by the conductor 11 to the armature 4, of the relay 2, and to one terminal of the alarm device or bell B. A conductor 11′ leads from the remaining terminal of the bell B to the armature 4′ of the relay R_3, and to the battery B_3. Arranged adjacent the armatures 3, 4, and 4′

of the relays R_1, R_2, and R_3, are the contacts 8, 9, and 10 which are connected in series, by the conductor 12, with the indicating device or bell A. The conductor 12 is also connected to the remaining terminal of the battery B_3. The positive side of the battery B_1 is connected by the conductor 2′ through the controlling key T to the negative side of the circuit 2—2, while the negative side of the battery B_1 is connected by the conductor 2″ to one terminal of the relay R_3, while the remaining terminal of the latter is connected to the negative side of the battery 2 by means of the conductor 2‴. If the temperature rises to a dangerous point, so that the mercury in the thermal circuit closers or thermometers M_1, M_2, M_3 or M_4 makes contact between the connected sides of the looped circuits 1—1, 2—2, and if such rise of temperature occurs, for the sake of illustration, at the thermometer M_1 current flows from the positive side of the battery B_1 through the conductor 1, the galvanoscope G_1, the relay R_1, the conductor 5, the thermometer M_1, the conductor 6, the negative side of the looped circuit 2—2, the negative side of the battery B_2, the conductor 2‴, the relay R_3, and to the negative side of the battery B_1. The armature 4′ of the relay R_3 is attracted thus establishing a closed circuit through the battery B_3 and the alarm device A. A disturbance of the system which might be caused by the breaking of a conductor or by failure of current supply from either of the batteries B_1 or B_2, an indication of such disturbance will be indicated in the following manner:— If for instance the disturbance occured by failure of the battery B_1, the relay R_1 is deënergized and releases its armature 3 which engages the contact 9 thereby closing the following circuit: Current flows from the positive side of battery B_3 through the conductor 12, the contact 9, the armature 3, the conductor 11, the alarm device B and the conductor 11′ to the negative side of the battery B_3. In a similar manner, a disturbance in either of the conductors 1—1, 2—2 or in the battery B_2, is indicated. For the purpose of controlling the relay R_3, which is deënergized under normal conditions, a control key T is connected in the conductor 2′ which leads from the positive side of the battery B_1 and is connected to the negative side of the looped circuit 2—2. If this control key T is closed, current flows from the positive side of the battery B_1 through the conductor 2′, the key T, the conductor 2‴, the relay R_3 and the conductor 2⁗ to the negative side of the battery B_1. The relay R_3 attracts its armature 7 against the contact 8 thereby closing the circuit through the battery B and the alarm device A. In this manner, it can be determined as to the working condition of the system at all times, by closing the control key T.

In the modification, Fig. 2, means have been provided for the adjustment of the danger point at which the thermometers may be desired to operate, and said means consist in the connections as illustrated in Fig. 1, being supplemented by an additional looped circuit 1^a. This looped circuit may be thrown into operation by means of a double contact switch S which is connected into the looped circuit 1—1. A conductor 5^a connects one side of the supplemental circuit to a point, slightly removed from that of the connection 5 from the circuit 1—1, while a conductor 6′ connects one side of the looped circuit 2—2 to the circuit closers at a point removed from the connection of the conductors 6. If for instance, the conductors 5 (Fig. 1) should be connected to the thermometers M_1, M_2, M_3 and M_4 at a point whereby the circuit is completed at a thirty (30) degree temperature rise, the conductors 5′ (Fig. 2) would be connected, at a point for the completion of the circuit at a higher temperature, say fifty (50) degrees, so that by throwing the switch S from the terminals of the looped circuit 1—1 to the terminals of the looped circuit 1^a—1^a, as shown, the alarm would not be operated until the temperature had risen to the higher contact or fifty (50) degrees, and by throwing the switch S to the terminals of the looped circuit 1—1 the alarm will be operated when a thirty (30) degree rise in temperature is reached.

In the modification (Fig. 3), provision is made for increasing the range of the system and comprises an additional current supply B_3 which is connected by the conductor 2^a to the positive side of the looped circuit 1—1 and by the conductor 2^b to the negative side of the looped circuit 2—2. Thus closed circuits are established as follows:—1st. From positive terminals of the battery B_1 through the galvanoscope G_1, the relay R_1, the looped circuit 1—1 to the negative terminal of the battery B_1. 2nd. From the positive terminal of the battery B_2 through the galvanoscope G_2, the relay R_2, the looped circuit 2—2, all of the thermometers, and back to the negative side of the battery B_2. 3rd. From the positive terminal of the battery B_3 by the conductor 2′ to the one terminal of the relay R_3 and by the conductor 2″ from the other terminal of the relay R_3 back to the negative side of the battery B_3. The purposes and operation of these circuits is similar to that as in the connections of Fig. 1. It will be noted that three thermometers or circuit closers have been provided for each compartment or room, which compartments or rooms are designated D, E, and F, and that each set of thermometers are provided with conductors leading to a common connection forming one terminal of an auxiliary circuit

controlling relays R_4, R_5, and R_6, respectively, which are normally deënergized. The armatures of the relays R_4, R_5, and R_6, are respectively connected by the conductors 18, 19 and 20, to one side of the looped circuit 1—1, and to corresponding segments 18′, 19′ and 20′ of the plug switch board S′. The oppositely arranged segment *a* and *b* of the plug switch board S′ are connected by the other side of the looped circuit 1—1. The segments 18′, 19′ and 20′ are connected to the drop annunciator F′, E′ and D′, respectively, and which drop annunciators are, by a common connection, connected by the conductor 11′ to one terminal of the alarm bell A. A second plug switch board S_2 is connected in a similar manner to the looped circuit 2—2, but is not provided with the relay control device as in the first instance. The purpose of which plug switch board will be hereinafter more fully set forth. As an illustration of the operation of the several circuits, should a dangerous increase of temperature occur in the room E, and, for instance, cause the mercury in the thermometer M_2'' to close the circuit therethrough, the following circuit would be established: Current from the positive side of the battery B_3 would flow through the conductor 2^a, the conductor 1 to the branch connection to the relay R_5, the conductor leading to the thermometer M_2'', the conductor 2^a and the conductor 2^b to the negative side of battery B_3. The completion of this circuit would then establish the following circuit:—Current flows from the positive terminal of the battery B_4 through the conductor 11, the alarm bell A, the conductor 11′, the annunciator drop E, the conductor 19, the armature of the relay R_5, the conductor 12, and back to the negative terminal of the battery B_4. The alarm bell A and the annunciator drop E will continue to operate until the contact in the thermometer M_{11}'' is interrupted or until the alarm bell A is disconnected by a switch. Similar circuits are established when either or all of the other thermometers are submitted to the necessary rise in temperature. In view of the breakage of a wire in either of the looped circuits, such circuit may be disconnected from the system by plugging in the proper segments of the switch boards S_1 and S_2, so that it is not necessary to place the entire system out of commission. If for instance, the conductor 1 is broken as at G, H in the room E, plugs are inserted in the aperture 13 and 15, on the switch board S_1, so that the circuits connecting room E are broken as is shown by the following connections: from the positive side of the battery B_1, the conductor 1, branch 17, conductor 18, conductor 1, branch 19, plug 15, conductor 20, conductor 1 and back to the negative terminal of the battery 1. This leaves the circuit connected to rooms D and F in operative condition. If the looped circuit 2—2 should be interrupted or broken at I and K, in the room E, plugs are inserted in the contact aperture 14 and 16, of the switch board S_2, and the following circuit is thrown out of operation for repairs:—from the positive terminal of the battery B_2, the conductor 2, conductor 18, plug 14, conductor 19, conductor 2, branch 20, plug 16, conductor 21, conductor 2, and back to the negative side of the battery B_2. It is obvious, from the above, that the circuits connecting either or all of the rooms D, E, and F, may be controlled from the switch boards.

In the modification, Fig. 4, the system as disclosed in Fig. 3 is supplemented by the addition of fire extinguishing devices or sprinklers, and, for the sake of simplicity, connections for two rooms only are shown. The sprinklers, preferably of the fusible type, are connected to the electro-mechanically actuated valves V_1 and V_2 which are disposed in the circuits controlled by the thermometers. For illustration, if the circuit is closed at either of the thermometers in the room D, the relay R_4 is energized and by means of the control conductor 20, the drop D′ is actuated and simultaneously the valve V_1 is actuated, and furthermore the alarm bell A will ring. This circuit extends from the positive terminal of the battery B_4, conductor 12′, relay contact R_4, armature of the relay R_4, conductor 12, valve V_1, and back to the negative terminal of the battery B_4, at the same time the following circuit is completed:—from the positive terminal of the battery B_4, conductor 12′, relay armature R_4, conductor 20, drop D′, conductor 11′, alarm bell A, conductor 11, and back to the negative terminal side of the battery 4. In this instance if the sprinklers connected to the valve V_1 are of the open type, water will continue to flow therethrough until the temperature is lowered and the circuits are returned to their normal condition, and when such condition is reached the valve V_1 is closed automatically, the drop D is automatically restored and the alarm bell ceases to ring. The same operation occurs when the temperature increases in any of the other rooms.

In the modification, Fig. 5, a special safety connection is provided to protect the alarm thermometers against accidental overheating. In each of the rooms having two or more of these thermometers or in adjacent rooms, double relays X and X′ are provided, the magnets of which are connected in parallel to each other, and each of the magnets are connected to two of the thermometers which actuate the sprinklers. These relays X and X′ are actuated only when the temperature has risen to point of contact in the two thermometers to which each of the magnets of the double relay are

connected. An illustration of the operation, is shown, by the following circuit which is established should a fire occur in the room D near the alarm thermometer M_1:—Current flows from the positive terminal of the battery B_3, conductor 2, positive pole of battery B_1, conductor 1, relay R_4, alarm thermometer M_1, conductor 2, and back to the negative terminal of the battery B_3. The relay R_4 attracts its armature and will complete the following circuit:—Current flows from the positive terminal of the battery B_4, conductor 11, alarm bell A, conductor 11', drop D, conductor 13, connector 14 of the relay armature R_4 and R_5, armature contact of relay R_4, conductor 12, and back to the negative terminal of the battery B_4. The alarm A will ring and the drop D will be actuated. The valves and sprinkling devices, however, will not be actuated, due to the fact that there is no danger done as long as the thermometer has only been heated by accident and therefore the alarm only, is operated in conjunction with the drop annunciator, the latter indicating the point of disturbance, but if the rise of temperature is caused by fire, the heat will act upon the thermometers M_1', at the same time as upon the thermometer M_1, and will close the circuit through the relay R_5 which will be energized and will attract its armature which closes the circuit controlling the valve V_1. The latter circuit being as follows:—Current from the positive terminal of the battery B_5 will flow through conductors 17, branch 18, contact 19, conductor 20, contact 19^a, conductor 21, valve V_1, and back to the negative terminal of the battery B_5. The valve V_1 will be actuated and will supply the sprinklers W with water.

Having thus described the invention and its several modifications, what is claimed as new is:—

1. A fire alarm system comprising a pair of normally closed circuits, a plurality of thermal circuit closers interposed in parallel relation between one side of each of said circuits, a pair of normally open alarm circuits, means controlled by each of said first mentioned circuits for closing one of said alarm circuits when said thermal circuit closers are actuated, and means controlled by said first mentioned circuits for closing one of said alarm circuits, should either of said first mentioned circuits be accidentally opened.

2. A fire alarm system comprising a pair of normally closed circuits, a plurality of thermal circuit closers connected in parallel between one side of each of said circuits, means interposed in said circuits for indicating operative condition of the circuits, a pair of normally open alarm circuits, means controlled by said first mentioned circuits for closing one of said alarm circuits when said thermal circuit closers are actuated and means controlled by said first-mentioned circuit for closing one of said alarm circuits should either of said first mentioned circuits be accidentally opened.

3. A fire alarm system comprising a pair of normally closed circuits, a plurality of thermal circuit closers adapted to connect one side of each of said circuits, means interposed in said circuits for indicating operative condition of the circuits, a pair of normally open alarm circuits, means controlled by said first mentioned circuits for closing one of said alarm circuits when said thermal circuit closers are actuated, means controlled by said first mentioned circuits for closing one of said alarm circuits should either of said first mentioned circuits be accidentally opened, and means for controlling one of said alarm circuits irrespective of the normal or abnormal condition of said first mentioned circuits.

4. A fire alarm system comprising a pair of normally closed circuits, a plurality of thermal circuit closers, adapted to connect one side of each of said circuits, means for adjusting said thermal circuit closers to operate at either of two desired degrees of temperature, means interposed in said closed circuits for indicating the operative conditions of the said circuits, a pair of normally opened alarm circuits, means controlled by said first mentioned circuits, for closing one of said alarm circuits when either or all of said thermal circuit closers are actuated, means controlled by said first mentioned circuits, for closing one of said alarm circuits, should either of said first mentioned circuits be accidentally opened, and manually operated means for controlling one of said alarm circuits irrespective of the normal or abnormal condition of the said first mentioned circuits.

5. A fire alarm system comprising a pair of normally closed circuits, a plurality of thermal circuit closers, adapted to connect one side of each of said closed circuits, a supplemental circuit having one of its sides connected to said circuit closers at a point removed from the point of connection from one of said closed circuits, means interposed in one of said closed circuits whereby to open said circuit and adapted to connect in said supplemental circuit, means interposed in said closed circuits for indicating operative condition of said circuit, a pair of normally opened alarm circuits, means controlled by said first mentioned circuits for closing one of said alarm circuits when either or all of said thermal circuit closers are actuated, means controlled by said first mentioned circuits for closing one of said alarm circuits should either of said first mentioned circuits be accidentally opened, and manually operated means for control-

ling one of said alarm circuits irrespective of the normal or abnormal condition of said first mentioned circuits.

6. A fire alarm system comprising a pair of normally closed circuits, a plurality of thermal circuit closers interposed in parallel relation between one side of each of said circuits, a pair of normally open alarm circuits, a relay controlled by each of said first mentioned circuits for closing one of said alarm circuits when said thermal circuit closers are actuated, and means controlled by said first mentioned circuits for closing one of said alarm circuits should either of said first mentioned circuits be accidentally opened.

7. A fire alarm system comprising a pair of normally closed circuits, a plurality of thermal circuit closers interposed in parallel relation between one side of each of said circuits, a pair of normally open alarm circuits, a relay controlled by each of said first mentioned circuits for closing one of said alarm circuits when said thermal circuit closers are actuated, and relays controlled by said first mentioned circuits for closing one of said alarm circuits should either of said first mentioned circuits be accidentally opened.

8. A fire alarm system comprising a pair of normally closed circuits, a plurality of thermal circuit closers connected in parallel between one side of each of said circuits, galvanoscopes interposed in said circuits for indicating operative condition of the circuits, a pair of normally open alarm circuits, means controlled by said first mentioned circuits closing one of said alarm circuits when said thermal circuit closers are actuated, and means controlled by said first mentioned circuits for closing one of said alarm circuits should either of said first mentioned circuits be accidentally opened.

9. A fire alarm system comprising a pair of normally closed circuits, a plurality of thermal circuit closers connected in parallel between one side of each of said circuits, galvanoscopes interposed in said circuits for indicating operative condition of the circuits, a pair of normally open alarm circuits, a relay controlled by said first mentioned circuits for closing one of said alarm circuits when said thermal circuit closers are actuated, and relays controlled by said first mentioned circuits for closing one of said alarm circuits should either of said first mentioned circuits be accidentally opened.

10. A fire alarm system comprising a pair of normally closed circuits, a plurality of thermal circuit closers adapted to connect one side of each of said circuits, galvanoscopes interposed in said circuits for indicating operative condition of the circuits, a pair of normally open alarm circuits, a relay controlled by said first mentioned circuits for closing one of said alarm circuits when said thermal circuit closers are actuated, relays controlled by said first mentioned circuits should either of said first mentioned circuits be accidentally opened, and means for controlling one of said alarm circuits irrespective of the normal or abnormal condition of said first mentioned circuits.

11. A fire alarm system comprising a pair of normally closed circuits, a plurality of thermal circuit closers adapted to connect one side of each of said circuits, galvanoscopes interposed in said circuits for indicating operative condition of the circuits, a pair of normally open alarm circuits, a relay controlled by said first mentioned circuits for closing one of said alarm circuits when said thermal circuits closers are actuated, relays controlled by said first mentioned circuits should either of said first mentioned circuits be accidentally opened, and a key for controlling one of said last mentioned circuits irrespective of the normal or abnormal condition of said first mentioned circuits.

12. A fire alarm system comprising a pair of normally closed circuits, a plurality of thermal circuit closers, adapted to connect one side of each of said closed circuits, a supplemental circuit having one of its sides connected to said circuit closers at a point removed from the point of connection from one of said closed circuits, a switch interposed in one of said closed circuits whereby to open said circuit and adapted to connect said supplemental circuit, means interposed in said closed circuits for indicating operative condition of said circuit, a pair of normally opened alarm circuits means controlled by said first mentioned circuits for closing one of said alarm circuits when either or all of said thermal circuit closers are actuated, means controlled by said first mentioned circuits for closing one of said alarm circuits should either of said first mentioned circuits be accidentally opened, and manually operated means for controlling one of said alarm circuits irrespective of the normal or abnormal condition of said first mentioned circuits.

13. A fire alarm system comprising a pair of normally closed circuits, a plurality of thermal circuit closers, adapted to connect one side of each of said closed circuits, a supplemental circuit having one of its sides connected to said circuit closers at a point removed from the point of connection from one of said closed circuits, a switch interposed in one of said closed circuits whereby to open said circuit and adapted to connect in said supplemental circuit, galvanoscopes interposed in said closed circuits for indicating operative condition of said circuit, a

pair of normally opened alarm circuits, means controlled by said first mentioned circuits for closing one of said alarm circuits when either or all of said thermal circuit closers are actuated, means controlled by said first mentioned circuits for closing one of said alarm circuits should either of said first mentioned circuits be accidentally opened, and manually operated means for controlling one of said alarm circuits irrespective of the normal or abnormal condition of said first mentioned circuits.

14. A fire alarm system comprising a pair of normally closed circuits, a plurality of thermal circuit closers, adapted to connect one side of each of said closed circuits, a supplemental circuit having one of its sides connected to said circuit closers at a point removed from the point of connection from one of said closed circuits, means interposed in one of said closed circuits whereby to open said circuit and adapted to connect in said supplemental circuit, galvanoscopes interposed in said closed circuits for indicating operative condition of said circuits, a pair of normally opened alarm circuits, a relay controlled by said first mentioned circuits for closing one of said alarm circuits when either or all of said thermal circuit closers are actuated, means controlled by said first mentioned circuits for closing one of said alarm circuits should either of said first mentioned circuits be accidentally opened, and manually operated means for controlling one of said alarm circuits irrespective of the normal or abnormal condition of said first mentioned circuits.

15. A fire alarm system comprising a pair of normally closed circuits, a plurality of thermal circuit closers, adapted to connect one side of each of said closed circuits, a supplemental circuit having one of its sides connected to said circuit closers at a point removed from the point of connection from one of said closed circuits, a switch interposed in one of said closed circuits whereby to open said circuit and adapted to connect in said supplemental circuit, galvanoscopes interposed in said closed circuits for indicating operative condition of said circuit, a pair of normally opened alarm circuits, a relay controlled by said first mentioned circuits for closing one of said alarm circuits when either or all of said thermal circuit closers are actuated, relays controlled by said first mentioned circuits for closing one of said alarm circuits should either of said first mentioned circuits be accidentally opened, and a manually operated means for controlling one of said alarm circuits irrespective of the normal or abnormal condition of said first mentioned circuits.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

OTTO RENNERT.

Witnesses:
A. V. W. COTTER,
MATHILDE R. HELD.