

Aug. 14, 1956

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2,759,174

FIRE DETECTOR

Filed Aug. 26, 1952

2 Sheets-Sheet 1

FIG. 1

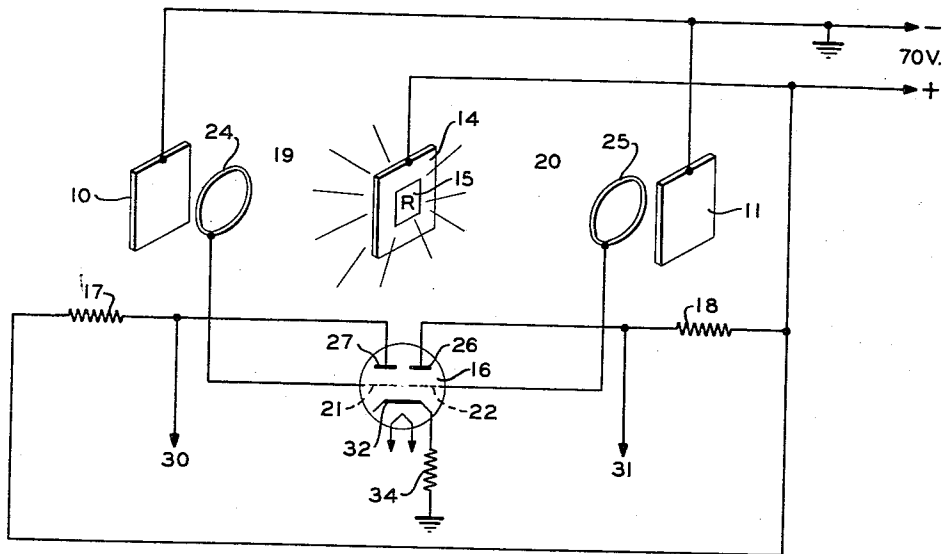
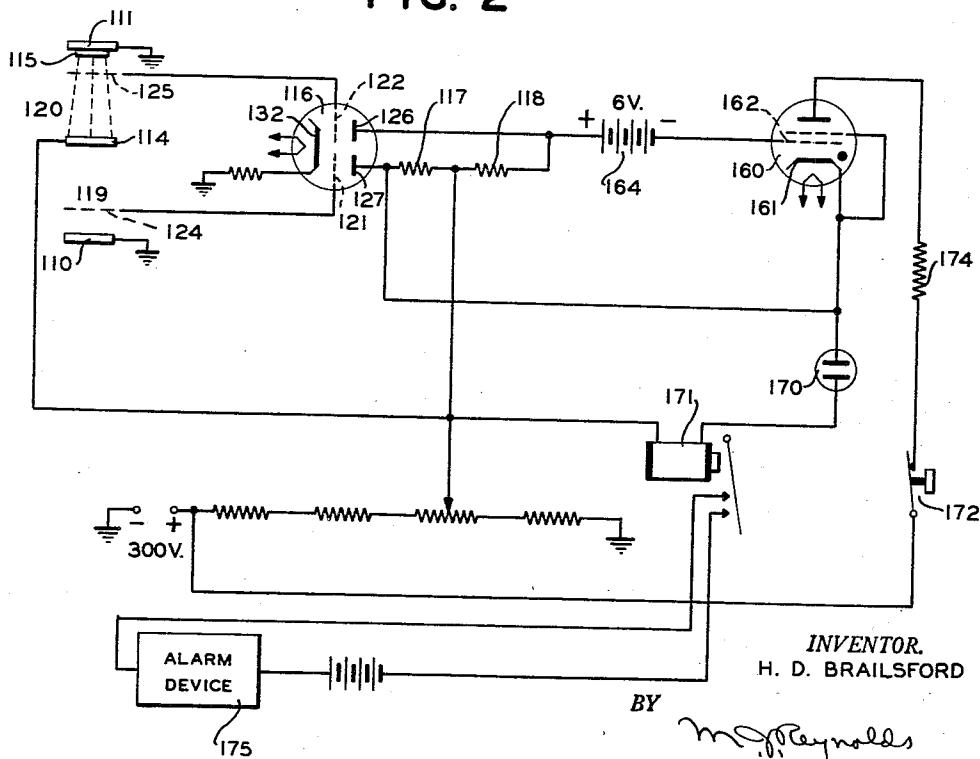


FIG. 2



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2 Sheets-Sheet 2

FIG. 3

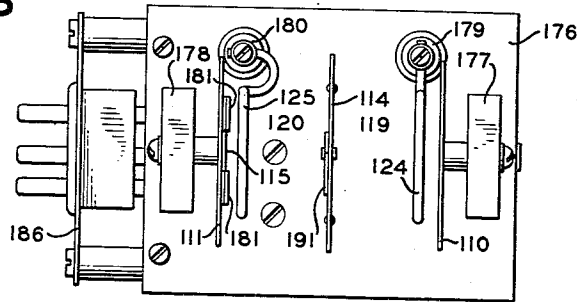


FIG. 4

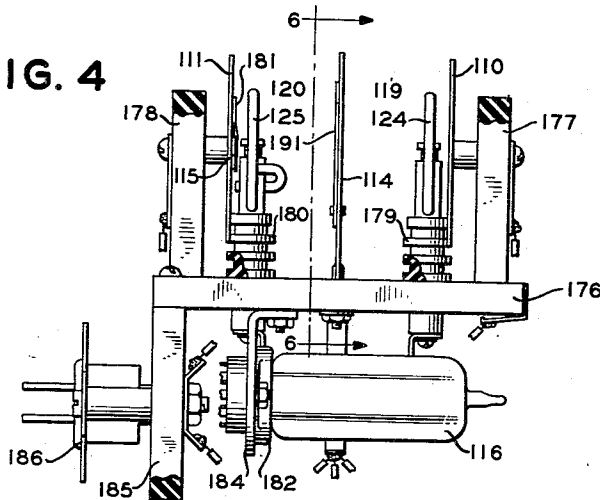


FIG. 5

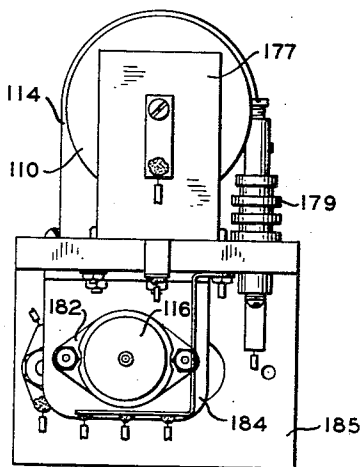
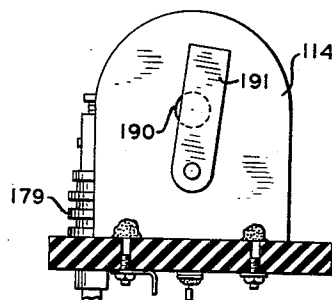


FIG. 6



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1

2,759,174

FIRE DETECTOR

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Application August 26, 1952, Serial No. 306,361

13 Claims. (Cl. 340-237)

This invention relates to improvements in fire detectors and more particularly to ionization type of flame and smoke detectors.

An object of the invention is to provide an improved fire detector utilizing the ionization principle in which a pair of adjacent chambers are equally accessible to products of combustion and are so related that a change in the conductivity of the atmosphere in one chamber relative to the other can be used to actuate an alarm.

Another object of the invention is to provide a fire alarm device as before described in which the two chambers are connected to a bridge circuit so that unbalance of one chamber relative to the other will unbalance the bridge.

A further object of the invention is to provide a device in which one of the two chambers has its atmosphere ionized to a greater degree than the other and connected in circuit arrangements as before described.

A further object is to provide a device as before described in which provision is made for varying the ionization of the atmosphere of one chamber relative to that of the other.

A still further object of the invention is to provide a compact, simplified detector structure which can be mounted at any desired place for detecting fires.

Other features, objects and advantages of the invention will become apparent by reference to the following detailed description of the accompanying drawings, in which—

Fig. 1 is a basic circuit diagram of the invention;

Fig. 2 is a circuit diagram illustrating an operative embodiment of the basic invention;

Fig. 3 is a plan view of a chassis embodied in the invention;

Fig. 4 is a side view thereof;

Fig. 5 is an end view thereof; and

Fig. 6 is a section taken substantially on the line 6-6 of Fig. 4.

Referring now to Fig. 1, a circuit diagram has been set forth to illustrate the basic principle involved in this invention. In this figure, 10 and 11 represent two electrodes which can be mounted in adjacent chambers with a common electrode 14 having radioactive material 15 thereon disposed between electrodes 10 and 11.

A medium mu twin triode 16 of the miniature type is connected in a bridge arrangement of which the two plate resistors 17 and 18 form two legs and the respective chambers 19 and 20 form the other two legs. The grids 21 and 22 are connected respectively to intermediate electrodes 24 and 25 in the respective chambers 19 and 20. Since chamber 20 has its atmosphere ionized by material 15 the grid 22 associated therewith has a bias applied thereto which tends to keep plate 26 negative with respect to plate 27.

Since the chambers 19 and 20 are equally accessible to products of combustion from a fire, it follows that the entry of the same into the chambers changes the character of the atmosphere in each thereof, varying

2

the conductivity of each. Variations of this character unbalance the relation between the chambers, in turn unbalancing the bridge arrangement, and if a meter or other indicating device is connected between points 30 and 31 it will be seen that the output voltage taken from plate to plate swings through a wide range with respect to the applied plate voltage. Such change of output voltage can be used for alarm purposes by controlling suitable alarm apparatus. It will be recognized that this circuit is actually a push-pull arrangement, and further that unbalancing of the chamber relation results in a regenerative action through the common cathode 32 due to the high value of the cathode resistor 34. At the same time normal atmospheric changes or changes occurring during a long time interval which affect both chambers 19 and 20 equally are balanced out if both grids 21 and 22 tend to swing to the same polarity.

A more elaborate circuit arrangement which has been used for fire or smoke detection is shown in Fig. 2. Again the chambers 119 and 120 are illustrated simply by the boundary electrodes 110, 111, and 114. However, radioactive material 115 is secured to electrode 111, instead of electrode 114 as in the Fig. 1 circuit. Electrode 114 has a gated opening 190 therein whereby some rays from source 115 may pass into chamber 119. In this circuit plate 127 is connected to cathode 161 of thyatron 160 while plate 126 is connected to the grid 162 thereof through a battery or source of bias cell voltage 164. This bias voltage serves to prevent the contact potential of the thyatron from reacting on the bridge arrangement which is similar to that described in connection with Fig. 1, in that plate resistors 117 and 118 form two legs of the bridge and chambers 119 and 120 form the other two legs. A neon lamp 170 is included in the thyatron circuit along with a relay 171, reset switch 172 and resistor 174. Relay 171 controls an alarm device 175 of any desired character well known to those familiar with this art.

As shown, chambers 119, 120 communicate with each other around the periphery of electrode 114 and chamber 120 has its atmosphere ionized to a greater degree than chamber 119. Consequently, different values of plate resistors are required to bring the bridge into balance. This balance can be attained more quickly by adjusting the gate in electrode 114 to permit more or less rays from source 115 to enter chamber 119. The gating arrangement is shown clearly in other figures of the drawings.

Assuming that the apparatus and circuit are in the normal or Fig. 2 condition in which the thyatron is not conducting, the entry of products of combustion into the chambers 119 and 120 will cause the bridge to become unbalanced, increasing the output potential and if the unbalance is of a predetermined minimum this potential will be sufficient to raise the thyatron grid potential to a point at which the tube fires. Immediate results are operation of relay 171 which on closing its contacts actuates the alarm device 175, and igniting of neon lamp 170 which puts a low impedance shunt across plate resistor 117, allowing the thyatron to continue conducting and maintaining the alarm condition of relay 171, even though the grid potential may drop. This alarm condition will continue until the thyatron is extinguished by momentarily opening reset switch 172.

The physical construction of a control unit which can be mounted in any desired location to be protected is shown in Figs. 3 to 6 inclusive. It is to be understood that the structure shown therein can be enclosed in suitable wire caging, perforated sheet metal or the like which will render the two chambers equally accessible to products of combustion. In these figures 176 represents a

3

base of insulating material having secured to the ends thereof upwardly extending blocks of insulating material 177 and 178 to which are fastened in spaced relation disk-like electrodes 110 and 111 respectively. Electrode 114 is secured to the base midway between 110 and 111. Intermediate electrodes 124 and 125 are supported by insulators 179 and 180 respectively. The strip of radioactive material 115 is held against electrode 111 by spaced spring clips 181. A socket 182 for twin triode 116 is supported by an angle plate 184 secured to the under surface of base 176. A depending insulator plate 185 serves to support a plug 186 the prongs of which are connected to various elements by connections not shown. Other interconnections have also been eliminated.

As before mentioned, electrode 114 has an opening 190 substantially centrally located and the area of this opening can be controlled by pivoted gate 191, whereby ionization of chamber 119 can be varied for the purposes described, but in all events chamber 120 is subjected to a higher degree of ionization.

Modifications beyond the illustrated embodiment may be made within the scope of the invention as defined in the following claims:

What is claimed is:

1. In a detector of the class described, a pair of chambers constructed so as to be equally accessible to products of combustion, the atmosphere of each of said chambers being ionized with one of said chambers being ionized to a greater degree than the other, said chambers being included in a bridge arrangement normally balanced and becoming unbalanced by variations in chamber atmosphere conductivity, and means whereby bridge unbalance actuates an alarm.

2. In a detector of the class described, a pair of chambers constructed so as to be equally accessible to products of combustion, the atmosphere of each of said chambers being ionized with one of said chambers being ionized to a greater degree than the other, said chambers being included in a normally balanced bridge arrangement, means whereby variation in the conductivity of the chamber atmospheres creates a potential variation, and means actuated by said potential variation to operate an alarm.

3. In a detector of the class described, a pair of chambers constructed so as to be equally accessible to products of combustion, the atmosphere of each of said chambers being ionized with one of said chambers being ionized to a greater degree than the other, said chambers being included in a normally balanced bridge arrangement, means whereby variation in the conductivity of chamber atmospheres creates a potential variation applied to the control grid of a thyatron to fire the same under predetermined conditions, and means controlled by said thyatron for actuating an alarm.

4. In a detector of the class described, a pair of chambers constructed so as to be equally accessible to products of combustion, the atmosphere of one of said chambers being ionized to a greater degree than the other, said chambers being included in a bridge arrangement normally balanced and becoming unbalanced by variations in chamber atmosphere conductivity, means whereby bridge unbalance actuates an alarm, and means for varying the normal ionization of the atmosphere of one of said chambers relative to that of the other.

5. In a detector of the class described, a pair of chambers constructed so as to be equally accessible to products of combustion, the atmosphere of one of said chambers being ionized to a greater degree than the other, said chambers being included in a normally balanced bridge arrangement, means whereby variation in the conductivity of the chamber atmospheres creates a potential variation, means actuated by said potential variation to operate an alarm, and means for varying the normal ionization of the atmosphere of one of said chambers relative to that of the other.

6. In a detector of the class described, a pair of cham-

4

bers constructed so as to be equally accessible to products of combustion, the atmosphere of one of said chambers being ionized to a greater degree than the other, said chambers being included in a normally balanced bridge arrangement, means whereby variation in the conductivity of chamber atmospheres creates a potential variation applied to the control grid of a thyatron to fire the same under predetermined conditions, means responsive to operation of said thyatron to maintain the same operative irrespective of variations in the thyatron control grid potential, means controlled by said thyatron for actuating an alarm, and means for varying the normal ionization of the atmosphere of one of said chambers relative to that of the other.

7. In a detector of the class described, a first electrode presenting a pair of oppositely disposed conductive surfaces, second and third electrodes spaced from said first electrode on respective sides thereof and each having a conductive surface defining, with a respective one of the surfaces of said first electrode, a chamber, each of said chambers being constructed so as to be equally accessible to the products of combustion, means for ionizing the atmospheres of said chambers so that the atmosphere of one chamber is more ionized than the atmosphere of the other of said chambers, means responsive to variations in chamber atmosphere conductivity to create a potential variation, and means actuated by said potential variation to operate an alarm.

8. In a detector of the class described, a first electrode presenting a pair of oppositely disposed substantially flat conductive surfaces, second and third electrodes spaced from said first electrode opposite respective flat sides thereof and each having a substantially flat conductive surface defining, with a respective one of the surfaces of said first electrode, a chamber, each of said chambers being constructed so as to be equally accessible to the products of combustion, means to render the atmosphere of one of said chambers more ionized than the atmosphere of the other of said chambers, said chambers being included in a normally balanced bridge arrangement, means responsive to variations in chamber atmosphere conductivity to create a potential variation thereby to unbalance said bridge, and means actuated by the unbalanced condition of said bridge to operate an alarm.

9. In a detector of the class described, a first electrode presenting a pair of oppositely disposed conductive surfaces, second and third electrodes spaced from said first electrode on respective sides thereof and each having a conductive surface defining, with a respective one of the surfaces of said first electrode, a chamber, each of said chambers being constructed so as to be equally accessible to the products of combustion and being included in a normally balanced bridge arrangement, means to render the atmosphere of one of said chambers more ionized than the atmosphere of the other of said chambers, means responsive to variations in chamber atmosphere conductivity to create a potential variation thereby to unbalance said bridge, a thyatron having a control grid coupled to said bridge circuit and being arranged to fire said thyatron in response to a predetermined unbalance of said bridge, an alarm arranged to be actuated upon firing of said thyatron, and means responsive to operation of said thyatron to maintain said bridge in unbalanced condition independent of further variations in chamber atmosphere conductivity.

10. In a detector of the class described, a first electrode presenting a pair of oppositely disposed substantially flat conductive surfaces, second and third electrodes spaced from said first electrode opposite respective flat sides thereof and each having a substantially flat conductive surface defining, with a respective one of the surfaces of said first electrode, a chamber, each of said chambers being constructed so as to be equally accessible to the products of combustion and being included in a normally balanced bridge arrangement, means to render

5

the atmosphere of one of said chambers more ionized than the atmosphere of the other of said chambers, means for varying the normal ionization of the atmosphere of one of said chambers relative to that of the other comprising an adjustable aperture in said first electrode, means responsive to variations in chamber atmosphere conductivity to create a potential variation to unbalance said bridge, a thyatron having a control grid coupled to said bridge circuit and being arranged to fire said thyatron in response to a predetermined unbalance of said bridge, an alarm arranged to be actuated upon firing of said thyatron, and means comprising a neon lamp included in the cathode circuit of said thyatron and being coupled in shunt relation with one of the arms of said bridge to maintain said bridge in unbalanced condition independent of further variations in chamber atmosphere conductivity.

11. In a detector of the class described, a normally balanced bridge network including a plurality of legs and adapted to establish a potential upon unbalance thereof for energizing an alarm, electrode means forming a pair of chambers each equally accessible to products of combustion, means for ionizing the atmosphere in said chambers so that one chamber is ionized to a greater degree than the other, and said chambers each respectively forming a variable portion of one of said network legs, whereby variation in the conductivity of the atmosphere of said chambers unbalances said network.

12. In a detector of the class described, a normally balanced bridge network including a plurality of legs and adapted to establish a potential upon unbalance thereof for energizing an alarm, electrode means forming a pair of chambers each equally accessible to products of combustion, means for ionizing the atmosphere in said

6

chambers so that one chamber is ionized to a greater degree than the other, said chambers each respectively forming a variable portion of one of said network legs, whereby variation in the conductivity of the atmosphere of said chambers unbalances said network, and means for varying the normal relative degree of ionization of said chambers thereby to adjust the bridge network.

13. In a detector of the class described, a normally balanced bridge network including a plurality of legs and adapted to establish a potential upon unbalance thereof for energizing an alarm, electrode means forming a pair of chambers each equally accessible to products of combustion and including an intermediate electrode between said chambers having an aperture formed therethrough, said chambers communicating one with the other through said aperture, means in one of said chambers for ionizing the atmosphere in said chambers so that one chamber is ionized to a greater degree than the other, said chambers each respectively forming a variable portion of one of said network legs, whereby variation in the conductivity of the atmosphere of said chambers unbalances said network, and means for adjusting said network including a movable member connected to said intermediate electrode for varying the size of said aperture and thereby the normal relative degree of ionization of said chambers.

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