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FLAME DETECTOR

Original Filed July 17, 1946

Fig. 1.

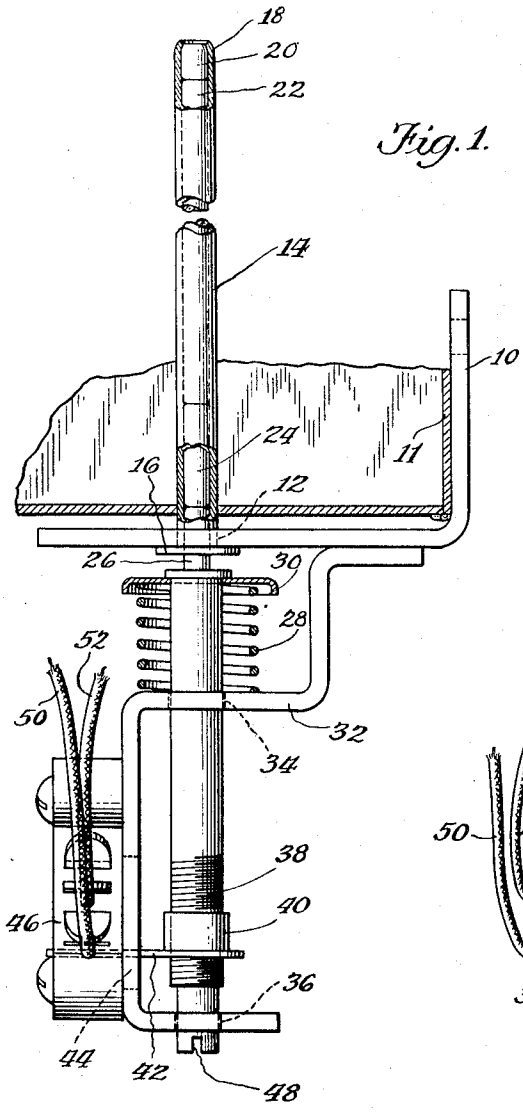
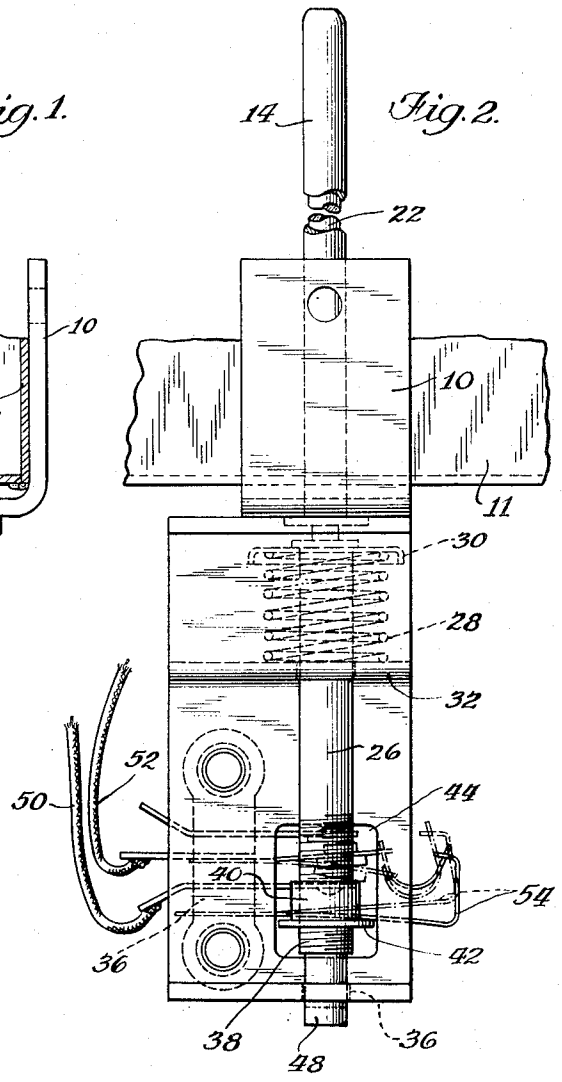


Fig. 2.



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FLAME DETECTOR

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2 Claims. (Cl. 200—137)

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The present invention relates to heating system control devices of the type known generally as "flame detectors," a flame detector being essentially a device which opens or closes an electric circuit depending upon the presence or absence of flame in the combustion chamber of a furnace or heater. The flame detector with which the present invention is concerned is of the thermostatic variety and this application is a division of our copending United States patent application Serial No. 684,350 filed July 17, 1946, for "House Heaters," now Patent No. 2,581,942.

It is an object of the present invention to provide a simple, relatively low cost flame detector which is relatively free of difficulties in service even though operated in a corrosive atmosphere at high temperatures for long periods.

A further object is to provide a novel flame detector having the above advantages and in which great reliability is achieved by means of an actuating element which is substantially non-resilient and which exerts a high order of force upon the switch element in spite of its small size and mass.

Yet another object is to provide a novel device of the above character which will retain the accuracy of its setting without drifting over long periods.

Other objects and advantages will become apparent from the following description of a preferred embodiment of our invention which is illustrated in the accompanying drawings.

In the drawings in which similar characters of reference refer to similar parts throughout the several views:

Fig. 1 may be considered as a top view of a flame detector according to the present invention although the device may be installed in any position; and

Fig. 2 is a side view thereof.

Flame detectors preferably should respond quickly to any change in the flame condition. They should therefore be of low mass and should be capable of operation quite close to the burning gases where the high temperature and corrosive atmosphere is very destructive. To have long life, therefore, they should be made of materials which are highly resistant to corrosion. Furthermore, to avoid difficulties in service, they should operate well within the elastic limits of the materials used so as to avoid any tendency toward drifting of the temperature setting. Preferably also, the thermosensitive element should develop a high order of force so that reliable and

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accurate switches of adequate electrical capacity can be incorporated in the device.

The device of the present invention incorporates these features and is based upon the differential expansion rate of fused quartz or a similar material on the one hand and a highly corrosive resistant metal such as high chromium content stainless steel or a similar material on the other hand.

The device is illustrated in detail in the drawings and comprises a suitable bracket 10 to be secured to a heat exchanger, a portion of which is indicated diagrammatically at 11, the bracket shown being L-shaped. It has an opening 12 through which a small diameter stainless steel tube 14 extends. One end of this tube is provided with a collar 16 so as to limit outward movement of the tube, this collar being in face-to-face relationship with the back or outer surface of bracket 10. The opposite end of the tube 14 is spun inwardly, as at 18 so as to prevent outward movement of a short stainless steel plug 20 located within the outer end of the tube. A loose-fitting fused quartz rod 22 is located within the tube and supports a loose-fitting stainless steel plug 24 located near the opposite end of the tube. The plug 24 in turn supports a stem 26 urged against the plug 24 by a coiled spring 28. This coiled spring bears at one end against a keeper 30 attached to the stem 26 while its opposite end presses against a portion of a bracket arm 32 welded to the L-shaped bracket 10. The bracket 32 is bent to have a U-shaped portion and opposite sides of the U are drilled so as to form two spaced aligned openings 34 and 36 through which the stem 26 extends. These openings prevent lateral movement of the stem but permit it to move inwardly and outwardly.

Near its outer end, the stem 26 is provided with threads 38 which are fitted to a threaded collar 40 having an actuating finger 42 which extends transversely through a slot 44 in the bracket 32. The extreme outer end of the stem 26 has a screw driver slot 48 for adjusting the position of the actuation finger 42 so as to determine the temperature at which the switch operates.

The switch 46 preferably is of the over-center snap type and may be of standard construction. Although the particular switch shown is manufactured by the Acro Electric Company at 1314 Superior Avenue, Cleveland, Ohio, and is known as Acro switch model M, it will be appreciated that there are numerous other types of small precision snap switches which would be suitable for the purpose. The particular switch shown has

contacts of the normally open type and completes the circuit between a pair of leads 50 and 52 when the finger 42 has moved its actuator 54 downwardly to a predetermined position.

The flame detector is mounted upon a heater so that the stainless steel tube 14 projects into the hot gas passage near the flame.

The flame detector operates in the following manner. Whenever the temperature in the hot gas portion of the heater rises, the temperature of the stainless steel tube 14 and quartz rod 22 will be rapidly raised. This causes the tube 14 to elongate because of its comparatively high terminal coefficient of expansion whereas the quartz rod remains substantially the same length because of its low thermal expansion coefficient. The result is that the inner end of the stem 26 moves inwardly along with the quartz rod. When the tube 14 has been heated to some predetermined temperature, the elongation will be sufficient so that inward movement of the actuating finger 42 will operate the snap switch 46, thereby closing the circuit to the flame detector relay. Conversely, cooling of the tube 14 causes it to contract and move the quartz rod and stem 26 downwardly as seen in the drawings thus actuating the switch 46 in the reverse direction.

Since in the flame detector as described the tube 14 is of a stainless steel which is highly resistant to corrosion even at high temperatures and since the tube 14 is not in contact with any dissimilar metal which might give rise to electrolytic action in the presence of hot corrosive gases, the actuating element of the device is substantially nondeteriorating. The quartz rod is of course practically inert chemically. It will be appreciated also that, since the tube 14 may have a comparatively thick wall and the quartz rod 22 has high physical values in compression, the action of the device is extremely positive and the spring 28 and switch 46 may be quite stiff in their response. All the above of course contributes to a rugged structure and a long trouble free life in service. It also permits the use of snap switches which are very precise in their operation but which require considerable force for their actuation.

Having described our invention, what we claim as new and useful and desire to protect by Letters Patent of the United States is:

1. A flame detector for a heater having a heat exchanger comprising a bracket adapted for securement to the heater, said bracket being shaped to provide a U-shaped portion having a pair of spaced parallel arms with aligned apertures therein, a stem adapted for longitudinal movement toward and away from said heat exchanger and guided against lateral movement by said apertures, a circuit making and breaking device secured to said bracket, a finger for operating said circuit making and breaking device, adjustable means for securing said finger to said

stem, a heat and corrosion resistant metal tube extending into said heat exchanger, said bracket having a portion lying substantially parallel to said spaced parallel arms and to which said tube is secured to be supported with its open outer end aligned with said stem guiding apertures, one end of said stem projecting into the outer end of said tube, a rod in said tube, means at the inner end of said tube for preventing movement of said rod therefrom, means in contact with the opposite end of said rod and said one end of said stem for resisting movement of said stem in one direction, resilient means acting between said bracket and said stem for urging said stem in said one direction so as to place said rod under compressive stress, said rod being formed of a material having a lower coefficient of thermal expansion than said tube.

2. A flame detector for a heater having a heat exchanger comprising a bracket adapted for securement to the heater, said bracket being shaped to provide a U-shaped portion having a base part and a pair of spaced parallel arms with aligned apertures therein, a stem adapted for longitudinal movement toward and away from said heat exchanger and guided against lateral movement by said apertures, a circuit making and breaking device secured to the outer face of the base of said bracket, an opening in the base of said bracket adjacent said circuit making and breaking device, said stem having a threaded portion between said bracket arms and opposite said opening, an element extending through said opening for operating said circuit making and breaking device, a threaded collar screwed onto the threaded portion of said stem adjustably securing said element to said stem, a heat and corrosion resistant metal tube extending into said heat exchanger, said bracket having a portion lying substantially parallel to said spaced parallel arms and to which said tube is secured to be supported with its open outer end aligned with said stem guiding apertures, one end of said stem projecting into the outer end of said tube, a rod in said tube, means at the inner end of said tube for preventing movement of said rod therefrom, means in contact with the opposite end of said rod and said one end of said stem for resisting movement of said stem in one direction, resilient means acting between said bracket and said stem for urging said stem in said one direction so as to place said rod under compressive stress, said rod being formed of fused quartz.

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