Feb. 1, 1949. E. C. THOMSON 2,460,314

APPARATUS FOR SUPERVISING HEAT GENERATING MEANS

Filed March 15, 1944

Fig. 1.

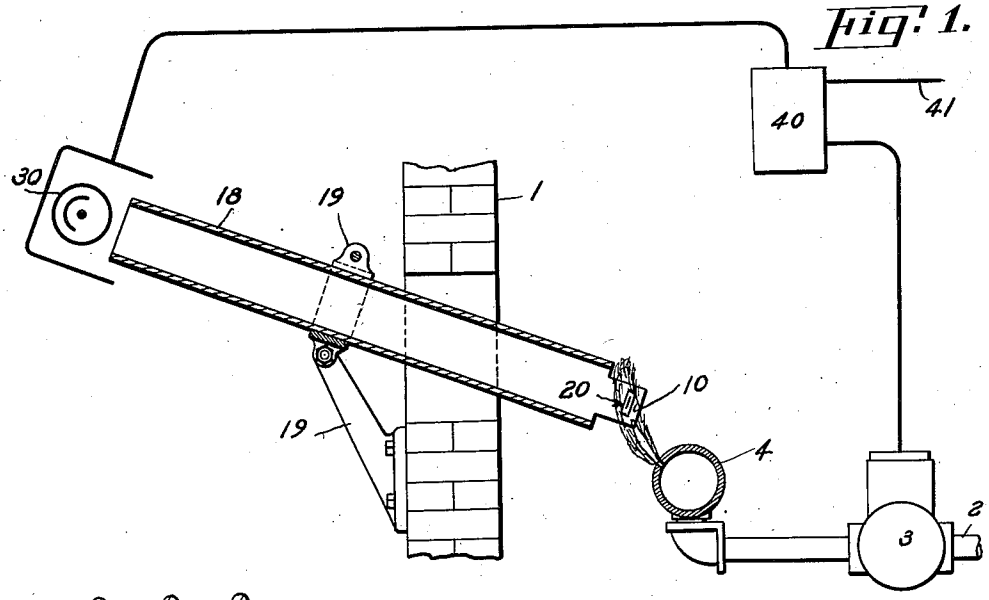


Fig. 2.

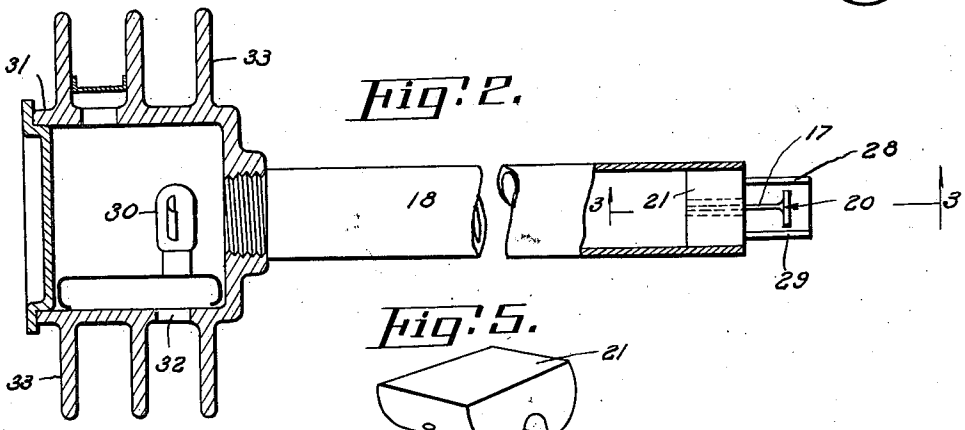


Fig. 5.

Fig. 3.

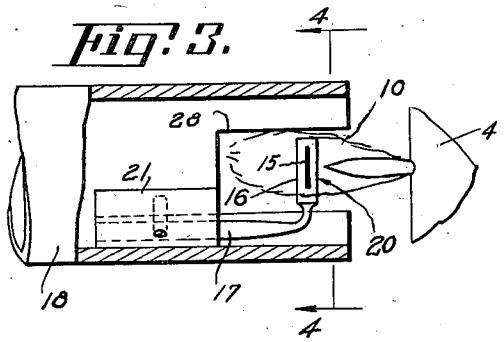
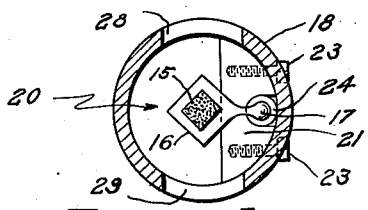


Fig. 4.



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APPARATUS FOR SUPERVISING HEAT GENERATING MEANS

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5 Claims. (Cl. 158—117.1)

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This invention relates to an arrangement for photoelectrically observing sources of radiation which emit at a frequency different from that to which the supervising electron discharge device is predominantly sensitive.

It is often desirable to supervise heat sources, for example the low intensity gas flames of baking ovens, which radiate very little energy in those regions of the spectrum to which the most practical phototubes are primarily sensitive, namely the highest wave length region of the visible spectrum and the infrared region.

In order to supervise such flames with red and infrared sensitive phototubes it was heretofore necessary to use high amplification in the photoelectric circuit, which involves the disadvantages of instability and complexity of the control circuit and tends to render the control device unreliable.

It is one of the main objects of the present invention to avoid these disadvantages by introducing a radiation frequency converting link, in the form of an auxiliary radiator, between the primary radiator which emits little photoelectrically effective radiation, and the detecting phototube.

In another aspect, the invention also provides for amplification of photoelectrically effective radiant energy generally and in still another aspect it provides a very simple and reliable way of eliminating undesired intermittent operation of the control circuit due to flicker of the supervised flame.

These and other objects and aspects will be more fully apparent from the following description of a practical embodiment illustrating the genus of the invention. The description refers to a drawing in which

Fig. 1 is a diagrammatic representation of an oven control installation incorporating the invention;

Fig. 2 a side view, with the tube ends in section, of the observation unit shown in Fig. 1;

Fig. 3 a section on line 3—3 of Fig. 2;

Fig. 4 a section on line 4—4 of Fig. 3; and

Fig. 5 an axonometric view of the holding block shown in Figs. 2 to 4.

In Fig. 1, which shows the general arrangement of a practical embodiment of the invention, numeral 1 represents the wall or other enclosure element of an oven or furnace, 2 the fuel gas supply duct, 3 an electrically operated fuel valve, and 4 a burner tube of the conventional drilled port type using pre-mixed fuel.

Placed into the hottest portion of flame 10 is

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an auxiliary radiator element 20 which preferably consists of material capable of emitting when heated to the available temperature, radiation of the frequency to which commercial phototubes are preponderantly sensitive, namely the red to infrared frequency range.

The radiator element may consist of an emitter element 15 (Figs. 3 and 4), for example, of platinum or black oxidized tungsten comprising a rectangular strip $\frac{7}{32}$'' wide and $\frac{11}{32}$'' long of a thickness of approximately .001'' fused between two sheets of protective quartz approximately $\frac{3}{8}$'' wide and $\frac{1}{2}$'' long, the said quartz sheets being approximately .005'' thick and comprising the envelope 16, the envelope being supported on a rectangularly bent supporting rod 17 of quartz joined to the envelope 16 with a narrow neck which reduces heat conduction.

The radiator element 20 may be supported at the end of an observation tube 18 fastened to wall 1 by means of bracket 19 (Fig. 1) by means of a clamp block 21 (Figs. 2 to 5) having a slot 22 and fastened to the end of tube 18 by means of screws 23. The supporting rod 17 of the radiator element is held in the slot 22 of clamp block 21 by means of an asbestos lining 24 (Fig. 4).

On either side of radiator element 20, tube 18 is provided with cut-outs 28, 29 (Figs. 2 and 4) which admit flame 10 and also protect it, thereby reducing flickering.

At the outer end of tube 18 is arranged a phototube 30 for observing radiator 20. The tube may be mounted, with or without its amplifying and control circuit elements, in a protective housing 31 having appropriate provisions for cooling and ventilating the apparatus therewithin; such as slots 32 and fins 33.

The above-described arrangement operates as follows:

The flame 10 by itself does not radiate sufficient energy to which phototube 30 is effectively responsive, but retains the emitting element 15 incandescent so long as the flame burns, this element emitting intensive radiation of a wave length higher than that of the flame with which it is associated, and well within the range of the phototube sensitivity. On the other hand, the mass of body 20 can be so dimensioned that rapid fluctuation of the flame such as due to flutter can be rendered harmless by a selected time lag between the flame fluctuation and the corresponding radiation intensity of element 20, whereas the element can be made small enough to eliminate any danger of explosion due to delayed response of the supervising control appa-

ratus. The dimensions of the auxiliary radiator 20 may be reduced from the specific disclosure above set forth where conditions are favorable or desirable. In other words, the mass of the auxiliary radiator is so selected depending upon prevailing temperature conditions and control requirements, preferably by simple experiment employing a series of sample elements of stepped size, that the effect of flame fluctuations within a given maximum duration is eliminated, whereas all longer fluctuations will cause cooling of element 20 to such an extent that the phototube becomes unresponsive.

With flame 10 burning and auxiliary radiator 20 emitting as above described, the phototube impedance is sufficiently reduced to actuate an amplifying and relay circuit indicated at 40 and supplied from a current source 41. Control valve 3 is thus maintained open so long as flame 10 burns. Upon extinction of the flame, the phototube impedance increases and the control circuit closes valve 3.

It will be understood that, instead of the arrangement including tube 18, any structure which provides proper correlation of the primary heater such as flame 10, of the auxiliary radiator 20 and of the phototube 30 may be used.

It will be further understood that the use of arrangements according to the invention is not restricted to gaseous fuel equipment such as herein shown by way of example, but that it can be advantageously applied to any heating system which provides analogous problems of supervision and control.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. In apparatus for supervising an energy source adapted to radiate predominantly at a certain frequency range, with a radiation responsive device predominantly sensitive to a second frequency range, the combination of said source and said device with an auxiliary radiator comprising an incandescible radiator element sealed within a heat conducting envelope located in said source and adapted to radiate said second range upon being subjected to heating from said source.

2. Apparatus for supervising a heat generating means, comprising said heat generating means which radiates light of a comparatively low intensity, a light responsive device arranged for supervising said heat generating means, and a body arranged to be heated by said heating means and adapted to radiate light of a comparatively high intensity when heated by said heating means, the said body comprising an incandescible member imbedded in a transparent heat conducting envelope located in said energy source.

3. In a flame supervising apparatus having a heat source and a light responsive device for the purpose of supervising said energy source, an improved light radiator interposed between said heat source and said light responsive device for the purpose of supervising said heat source, said light radiator comprising an incandescible member contained in a transparent envelope which envelope is located in said heat source, and adapted to become incandescent only when said heat source is emitting heat.

4. An improved light radiator in combination with a heat source, said radiator comprising an incandescible element sealed in a transparent envelope, the said element becoming incandescent only when said heat source is emitting, said heat source being external to said envelope in heat transfer relation therewith.

5. An improved light radiator in combination with a heat source, said radiator comprising an incandescible element sealed in a transparent fused envelope, the said element becoming incandescent only when said heat source is emitting, said heat source being external to said envelope in heat transfer relation therewith.

E. CRAIG THOMSON.

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