March 7, 1967 E. F. REXER 3,307,613

CONTROL APPARATUS

Filed Sept. 3, 1965

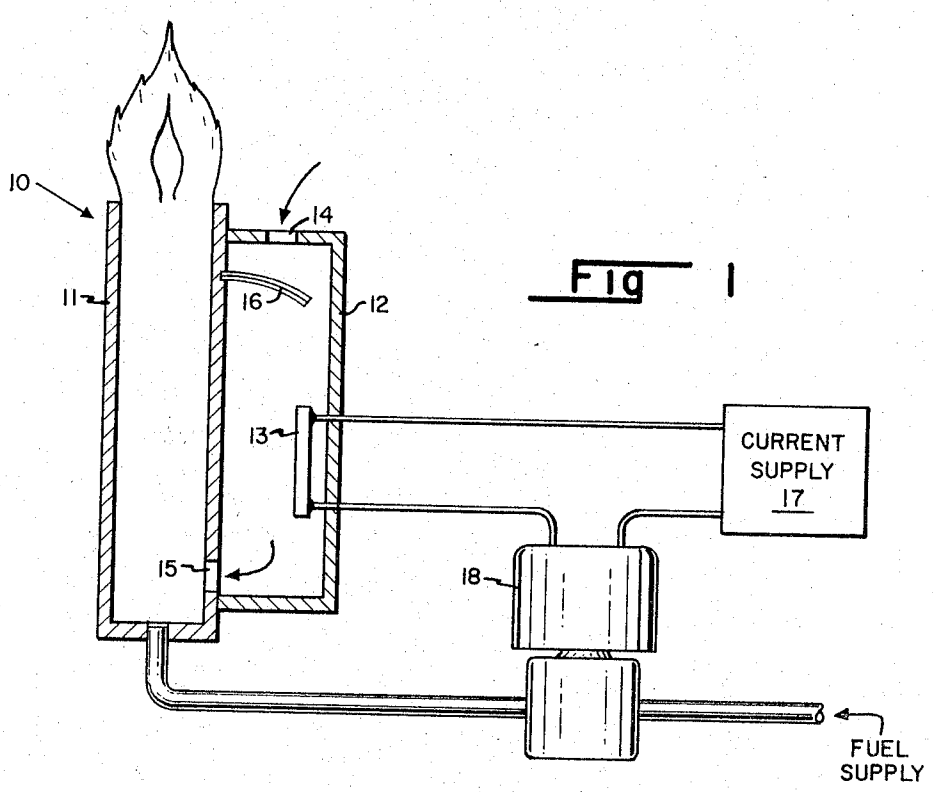

Fig 1

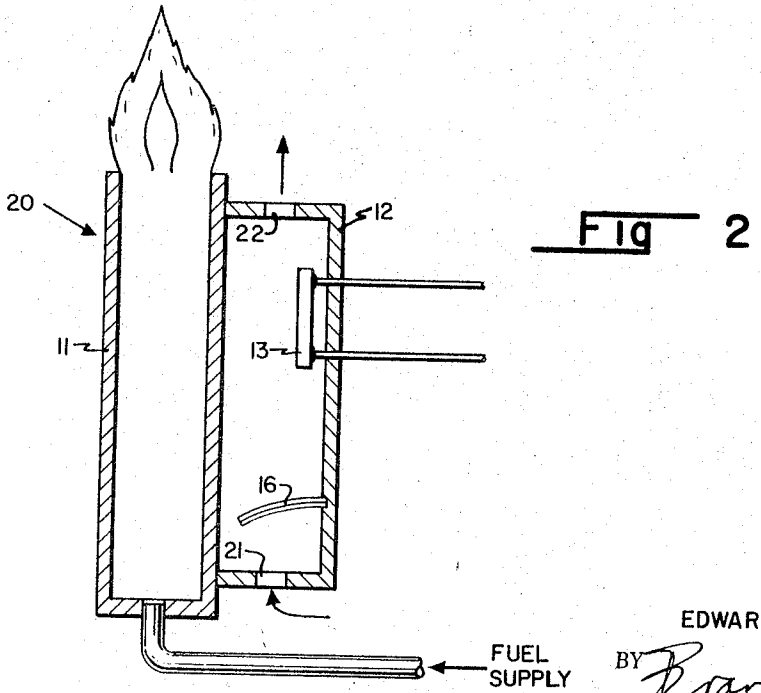

Fig 2

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CONTROL APPARATUS

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This invention relates to a burner control apparatus. More particularly, it relates to a control apparatus for use with gaseous fuel burners which require an oxidizing component to be mixed with the fuel prior to combustion. Usually, the oxidizing component is combustion air and it will be so referred to hereinafter.

There is provided by this invention a combination including a burner means, which may be either a pilot burner, a main burner alone or a main burner with pilot burner; a sensor means, and a control means connected to the sensor means. The control means in most cases will be a valve but it can also simply be a relay, an alarm means or the like. The sensor means actuates the control means and may control the flow of fuel to the burner means.

The main feature of this control apparatus is the sensor means which is capable of responding to two different conditions. The sensor means responds to certain predetermined amounts of carbon monoxide and hence monitors and controls the carbon monoxide level of the environment in which the apparatus operates. It also responds to the temperature of the burner means. That is, should the burner flame become too low or be extinguished, the sensor means will shut off the flow of fuel to the burner means.

Thus, there is provided a simplified control apparatus, such as a combination safety pilot and carbon monoxide control, having advantages which are particularly important for use in space heater type apparatus where potential asphyxiation has long been a problem. The advantages accrue in great part to the use of the single sensor means to provide a simplified burner apparatus which is capable of responding to the burner temperature and the carbon monoxide level in the environment surrounding the burner system without the use of a plurality of sensing means. In other words, the simplified apparatus utilizes the single sensor to detect two different conditions.

The invention will be more readily understood by reference to the drawings in which like reference characters indicate like elements throughout;

FIGURE 1 is a schematic illustration of one type of burner control in accordance with this invention, and

FIGURE 2 shows a second embodiment of the invention.

The embodiment shown in FIGURE 1 utilizes a burner means of the primary aerated type generally indicated as **10**. Burner means **10** includes a burner body **11** having a housing **12** which is laterally attached and adjacent thereto. Housing **12** is attached to burner body **11** so as to be in a good heat exchange relationship therewith. Housing **12** contains sensing means **13** which is sensitive to both carbon monoxide and the temperature of burner **10**. There is provided in the upper part of housing **12** an inlet port **14** which opens into housing **12** to allow the entrance of the environmental atmosphere surrounding burner **10** as indicated by the arrow in the figure. An inlet port **15** is also provided in the lower portion of burner body **11** to allow the passage of the environmental atmosphere from the housing into the interior of burner body **11** as indicated by the arrow in the figure. Once in the interior of burner body **11**, the environmental atmosphere mixes with the fuel supplied to the burner

to form a combustion mixture. A bimetal strip **16** is optionally provided in housing **12**. Since bimetal strip **16** is temperature sensitive, it operates as a damper to control the flow of air through housing **12** via inlet port **14**. The bimetal therefore functions to maintain the temperature in housing **12** within an operative range for sensor **13**. Since the bimetal contracts when it is heated to allow a substantially unrestricted flow of ambient air into housing **12**, the interior of the housing will be maintained below an upper temperature limit. On the other hand, the bimetal will expand when cooled to substantially restrict the flow of ambient air through the housing. Thus the flow of air will be restricted and the temperature inside the housing will be maintained above a lower temperature limit. It can be seen that the damping action of bimetal **16** will maintain the temperature range within housing **12** which is adapted to the suitable operation of sensor **13** without being either too high or too low.

Sensor **13** is of the type which, as previously stated, is responsive to burner temperature alone or to certain predetermined levels of carbon monoxide at certain predetermined temperatures. Such a sensor may, for example, be of the type disclosed in U.S. Patent application Serial No. 449,083, filed April 19, 1965, in the name of Francis J. Hughes, Richard E. Johnson and John D. Skildum which is assigned to the same assignee as the present invention. This particular type of sensor comprises a substrate material having a layer of tin oxide or the like thereon. The tin oxide responds to changing temperatures or to various levels of carbon monoxide at certain temperatures by a change in its electrical properties, such as its resistance. Thus, when sensor **13** is connected into a burner apparatus as shown in FIGURE 1, wherein it is mounted in housing **12** in a good heat exchange relationship with burner body **11**, electrically supplied by a suitable current supply **17** and connected to an electrically operated valve **18** in the fuel line to burner **10**, the sensor will control the supply of fuel to burner **10** depending on whether it senses high or low temperatures from the burner or a carbon monoxide level in the atmosphere surrounding the burner which exceeds any certain predetermined level.

The embodiment shown in FIGURE 2 utilizes a burner means of the non-primary aerated type generally indicated as **20**. Again, burner means **20** includes a burner body **11** having a housing **12** adjacent thereto. Housing **12** is again attached to burner body **11** so as to be in a good heat exchange relationship therewith. Housing **12** contains sensor **13** in the same manner as in FIGURE 1. In this type of a burner means, housing **12** is provided with an inlet port **21** which opens into the lower portion of housing **12** to allow the entrance of the environmental burner **20** as indicated by the arrow in the figure. An outlet port **22** is provided in the upper portion of housing **12** to allow the exit of the environmental atmosphere entering housing **12**. Again, bimetal strip **16** is optionally provided to control the flow of the environmental atmosphere through housing **12** depending on the temperature of the air which in turn is dependent on the temperature of the housing and the flow rate.

It can be seen that the operation of the burner system of FIGURE 2 is essentially the same as that of the system shown in FIGURE 1.

Having described the invention, what is claimed is:

1. In combination:

burner means;

control means;

sensing means, constructed and arranged to be responsive to a predetermined level of carbon monoxide and to a predetermined temperature;

means supporting said sensing means in the atmosphere surrounding said burner means and out of contact with any normal burner flame but in heat exchange relationship with said burner means, and

means connecting said sensing means in controlling relation to said control means, said sensing means responding to the temperature of said burner means and to the carbon monoxide content of the atmosphere surrounding said burner means to actuate said control means when the carbon monoxide content of the atmosphere reaches said predetermined level or when said burner means no longer heats said sensing means to said predetermined temperature.

2. The combination of claim 1 wherein said control means is a valve for controlling the flow of fuel to said burner means.

3. The combination of claim 1 wherein said burner means is the type which burns a fuel mixed with combustion air and said sensing means is supported in the air supplied to said burner means for monitoring the carbon monoxide content thereof.

4. The combination of claim 3 wherein said burner means is of the primary aerated type having a burner body and including a housing adjacent to said burner body for housing said sensor, said burner body having a lower air inlet port opening into said housing, said housing also having an upper air inlet port whereby air from the environment surrounding said system may flow into said housing, past said sensor and into said burner body.

5. The combination of claim 4 wherein a bimetal means is mounted within said housing to control the flow of air therethrough depending on its temperature.

6. The combination of claim 3 wherein said burner means is of the non-primary aerated type having a burner body and including a housing adjacent to said burner body for containing said sensor, said housing having a lower air inlet port and an upper air outlet port whereby air from the environment surrounding said system may flow into said housing and past said sensor.

7. The combination of claim 6 wherein a bimetal means is mounted within said housing to control the flow of air therethrough depending on its temperature.

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