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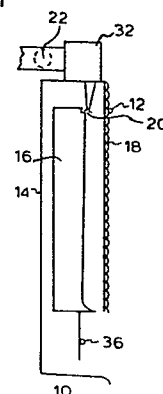
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54 Venting system monitor for open combustion gas fueled space heater.

57 A monitor for the venting system of open combustion gas fueled space heaters is disclosed. A sensor (12) is positioned near the vent slot (20) where the combustion gases are sucked from the heater (10). In sucking the combustion gases from the heater, however, room air (30) is also caused to pass over the sensor thereby cooling the sensor. If the venting system should malfunction, the sensor will be bathed in hot combustion gases (24) and the temperature recorded by the sensor will rise dramatically. When the sensor records a dramatic rise in temperature, the fuel to the heater is shut off.

FIG. 1



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D E S C R I P T I O N

"VENTING SYSTEM MONITOR FOR OPEN COMBUSTION
GAS FUELED SPACE HEATERS"

5 This application is an advancement of my previously issued U.S. Patent No. 3,963,414.

In the U.S., space heaters are presently most often used in confined areas such as boats, recreation vehicles and cabins. In Europe, space heaters are used to heat residences.

10 Widespread use of space heaters has been hindered by two drawbacks: excessive condensation in the space being heated and in conjunction with this problem accumulation of combustion products within the room including noxious gases. As an example, with propane fuel there
15 will be four gallons of water condensed for every gallon of fuel burned. In my previous patent, by means of suction, the combustion products were segregated and directed out of the room.

The segregation of the combustion products was an
20 important advancement for it eliminated the necessity of outside air flow directed through the heated room. For instance, without this segregation of combustion products, the user often had to crack a window in order to assure the safe dispersion of noxious fumes. The opening of a window or similar solution is a step backward
25 for the purpose of the heaters is to warm the room in question and letting in outside, cold air naturally lessens the effectiveness of the heaters.

Having eliminated the necessity of introducing
30 outside air, the proper functioning of the means of segregating the combustion gases is critical. If the segregation should cease the noxious gases will accumulate

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unknown to the inhabitants for the noxious gases are smokeless and substantially odorless.

In my previous patent the venting system utilizes a motor driven blower. Since the venting system is dependent on a motor driven blower, there is a strong possibility of an eventual undetected failure of the motor. It is also recognized that other conditions could seriously impair the venting system such as a vent discharge being blocked by snow or ice or unusual wind and atmospheric pressure. A further potential problem can be found if a vent discharge is improperly installed and, thus can permit an accumulation of a water trap or present too much resistance to the flow of gases.

A vent system monitor sensor is placed near the vent discharge slot. The sensor is so positioned that during normal vent operation the products of combustion are drawn into the vent slot together with some ambient air. The flow of cool ambient air over the vent monitor sensor maintains the sensor at a relatively low temperature.

In order to compensate for the wide variety of temperatures in which the heater may be placed, an ambient temperature compensating sensor is secure to the heater in a position minimally affected by the radiating heat. Thus, there is given difference between the temperature experienced at the sensor at the slot and the ambient sensor. Thus, if the outside temperature should drop significantly, both the sensor near the slot and the ambient sensor will record proportional drops in temperature. The system is designed such that proportional drops in temperature will not shut off the fuel.

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However, if the venting system should malfunction, all of the hot combustion gases are no longer sucked through the venting slot. The hot combustion gases not sucked out through the venting slot then flow over the slot monitor sensor, quickly raising its temperature. Since the ambient sensor primarily records room temperature, the ambient sensor reports very little change in temperature. Since the system responds to change in the difference between the vent sensor and the ambient sensor, the sensor, upon recording the difference, causes the fuel to be shut off.

ON THE DRAWINGS

The primary use of the present invention is in conjunction with an open burner such as a gas-fired catalytic space heater 10 as illustrated in FIG. 1. In the preferred embodiment of FIG. 1, a catalytic heater similar to the catalytic heater disclosed in my U.S. Patent No. 3,963,414 is disclosed for illustrative purposes for this discussion. It is to be understood that the vent monitor sensor 12 disclosed is also applicable for use with other open burners.

The catalytic space heater 10 includes a casing 14 which houses the catalytic bed 16 which utilizes heat resistant inert non-metallic, preferably fibrous loosely felted substrate, to which a thin coating of platinum group metal has been applied to serve as a catalyst. The heat of the burning gas is radiated through a grill 18.

The typical catalytic bed space heater radiates heat into the room due to the radiation of heat from the bed 16. The bed is heated by the combustion of the gases, and ambient air alongside commingling into this

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fibrous structure with combustion directly aided by the catalytic deposit on the fibers of the bed 16. However, hot combustion gas is also allowed to escape into the room and to commingle with the air in the room. These
5 combustion gases, while adding additional heat, also produce condensation, depletion of oxygen, and possibly noxious gases such as carbon monoxide.

In my previous U.S. Patent No. 3,963,414 an apparatus capable of segregating the unconfined sheet gas
10 flow and channeling the flow out of the room is disclosed.

The effluent gas is drawn by suction through the gas collector slot 20, exhaust fan or blower 22. The exhaust fan or blower 22 becomes a very key element for
15 if the fan should no longer operate potentially noxious fumes can pervade the room.

As set forth previously, in reliance of the advancement of segregating the noxious fumes out of the room other safeguards, such as open windows, are no longer
20 needed. Thus, if the fan should fail, a potentially dangerous situation presents itself.

In FIG. 2 a detailed side view of the gas collector slot 20 is illustrated. As illustrated in FIG. 2, the sheet flow combustion gases 24 flow through the gas
25 collector slot 22 along walls 26 and 28.

Besides the sheet flow combustion gases 24 passing through the gas collector slot 20, air from the room 30 also is sucked through the slot due to the exhaust fan 22. The room air 30, by its relatively low temperature and movement, causes a cooling effect in the zone
30 of its movement. Within the path of the room air's travel is placed the vent monitor sensor 12.

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As set forth in FIG. 2, the vent monitor sensor 12 in the preferred embodiment is a temperature responsive thermistor. The particular thermistor used is manufactured by Serracin Western, Inc. and is a negative
5 temperature coefficient thermistor. The thermistor is made of sintered metallic oxides and is a very durable device. Further, the thermistor has the characteristic of a very steep change of resistance per degree change of temperature. It is to be understood, however, that a
10 number of other sensors will accomplish the desired result.

In the preferred embodiment, the vent monitor sensor 12 is located slightly below the gas collector slot 20 and generally below the outer edge of the room
15 side of the plenum 32. This location of the vent monitor sensor 12 assures that during the normal venting of the heater 10 enough ambient air is drawn around and over the vent monitor sensor 12 to maintain it at a temperature distinctly lower than the temperature of the hot combustion
20 gases flowing upward alongside the catalytic combustion surface being drawn into the gas collector slot 20.

The temperature of the vent monitor sensor 12 is further reduced by aluminum capsule 34. Although
25 other substances can be used, aluminum is chosen due to its ability to reflect infrared radiation. Because the capsule 34 is an inch or less from the catalytic bed 16 its temperature would be much more influenced by absorption from infra-red radiation without the good
30 infra-red reflectivity of the aluminum capsule 34. Due to the reflectivity of the capsule 34, the thermistor responds more closely to the temperature of the ambient air streaming over the surface of the capsule 34.

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Catalytic heaters 10 are subjected to wide variations of ambient temperature. Thus, a heater might be operated when the ambient air temperature is as low as -40° Fahrenheit or even as high as +85° Fahrenheit.

5 Another factor to be considered is that the temperature of the room air directly affects the temperature of the vent monitor sensor 12. Thus, if the temperature of the room should rise from -40°F to +50°F the vent monitor sensor will record an increase of
10 approximately 90°F. However, the user may wish that the heater 10 continue to operate despite the increase in temperature. To assure the continued operation of the heater 10 an ambient sensor 36 is used in order to compensate for the effect of the change in room temperature and thereby assure operation throughout these
15 variations of temperature.

As set forth in FIG. 1, the ambient sensor 36 is positioned below the bed 16 of the heater. Thus, the ambient sensor 36 is relatively unaffected by direct
20 heat of the heater 10 but rather responds to the room temperature.

Thus, in the above example, if the temperature rises from -40°F to +50°F the ambient sensor also records a +90°F increase. Thus, both sensors remain balanced.
25 The importance of this balance will be explained subsequently.

As illustrated in FIG. 3, if either the exhaust fan 22 or a vent should be blocked, the sheet flow combustion gases no longer escape through the gas collector slot 20. Also, the room air 30 no longer flows through the gas collector slot 22. Thus, the sheet flow combustion gases 24 flow around the vent monitor sensor 12

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and naturally raise the temperature of the vent monitor sensor 12 dramatically. Typically, the temperature will rise an average of 100°F when sheet flow combustion gases flow over the venting monitor sensor.

5 The circuit utilized in the preferred embodiment to sense and utilize this change in temperature is illustrated in FIG. 4. It is to be understood that a number of variations of the circuit could be utilized to obtain the desired result.

10 In FIG. 4 a Wheatstone bridge 38 is utilized. From connection 40 is passive line 42 which leads to the negative connection 44 of the voltage comparator 46. From connection 48 is line 50 which leads to the positive connection 52 of the voltage comparator.

15 From the connection 54 to connection 48 is positioned the vent monitor sensor (thermistor) 12. Similarly, between the connection 56 and connection 48 is positioned the ambient sensor (thermistor) 36.

20 The various circumstances and how they affect the circuit in FIG. 4 will now be discussed.

25 If the vent system is working properly there will be no change experienced between the vent monitor sensor 12 and the ambient sensor 36. Thus, the Wheatstone bridge 38 will be balanced and the voltage comparator 46 will experience a voltage bias inhibiting a voltage comparator output. It is to be noted that the negative connection of the voltage comparator is assigned a slightly greater voltage than that experienced
30 at the positive connection. In this condition the voltage comparator 46 does not activate. The particular voltage comparator utilized is designated LM 2903.

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In the second circumstance the ambient temperature rises from -40°F to +85°F. This particular range of temperatures are chosen for it is in this range that the system is designed to operate. The system can be
5 designed to operate in even a larger range. During the rise in the ambient temperature both the ambient sensor 36 and the vent monitor sensor 12 rise in temperature and, thus, the thermistors drop in resistivity proportionately. Thus, the voltage experienced by the
10 voltage comparator 46 remains balanced and the voltage comparator 46 does not activate.

If the vent system should malfunction the vent monitor sensor rises in temperature dramatically. The ambient sensor remains relatively the same. The vent
15 monitor thermistor 12 also experiences a dramatic drop in resistivity and thus current and voltage flow towards the positive connection of the voltage comparator 46. When the voltage comparator experiences this unbalanced flow the voltage comparator activates and becomes a sink
20 with current flowing towards the voltage comparator 46.

This flow activates a shut-off system 58 which shuts off the flow of fuel. The shut-off system 58 can consist of conventional relays or circuitry which re-
25 spond to the drain caused by the activation of the voltage comparator.

Although a particular preferred embodiment of the invention has been disclosed above for illustrative purposes, it is to be understood that variations or modifications thereof which lie within the scope of the
30 appended claims are contemplated.

CLAIMS:

1. A venting system monitor for open combustion gas fueled space heaters comprising: a space heater with a gas collector slot for the venting of hot combustion
5 gases; a sensor positioned near the gas collector slot and in the path of movement of room air towards the gas collector slot when the venting system is operating; and a means of shutting off the fuel to the space heater when the sensor experiences a dramatic rise in temperature.
- 10 2. A venting system monitor for open combustion gas fueled space heaters comprising: a space heater with a gas collector slot for the venting of hot combustion gases; a sensor positioned near the gas collector slot and in the path of movement of room air towards the gas
15 collector slot when the venting system is operating; a sensor positioned away from the heat from the heater; a means of shutting off the fuel to the space heater when the sensor positioned near the gas collector slot rapidly rises in temperature and sensor positioned away from heat
20 from the heater remains relatively stable.
3. The venting monitor system of claim 2 wherein the sensors are thermally responsive thermistors.
4. The venting monitor system of claim 3 wherein the vent monitor thermally responsive thermistor is en-
25 capsuled in an infra-red reflective material.
5. The venting monitor system of claim 2 wherein the means for shutting off the fuel comprises: a Wheatstone bridge; a voltage source connected to the Wheatstone bridge; the vent monitor thermally responsive thermistor
30 placed across one leg of the Wheatstone bridge; the ambient thermally responsive thermistor placed across the opposing leg of the Wheatstone bridge from the vent

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monitor thermally responsive thermistor; a voltage comparator; a line connected from the passive corner of the Wheatstone bridge to a voltage comparator; a line connected from the passive corner of the Wheatstone bridge to a voltage comparator; a line connected from the corner of the Wheatstone bridge between the two thermistors to the voltage comparator; and a means of shutting off fuel to the heater when the Wheatstone bridge experiences a variation in voltage from the two lines.

FIG. 1

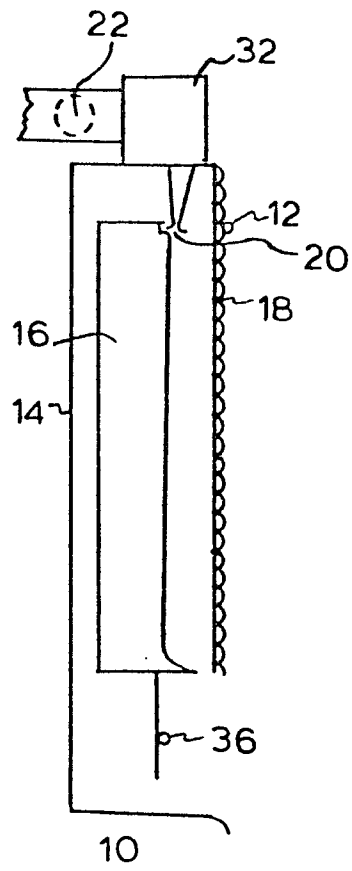


FIG. 2

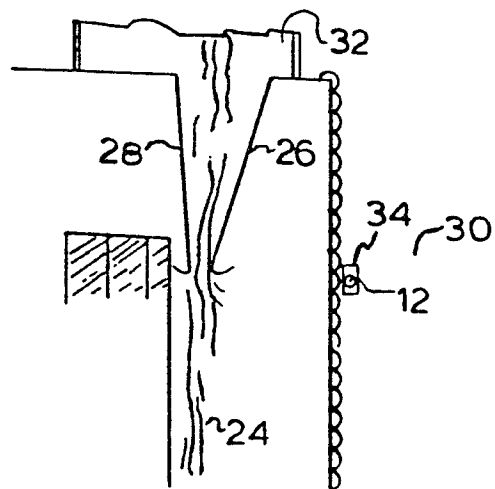


FIG. 3

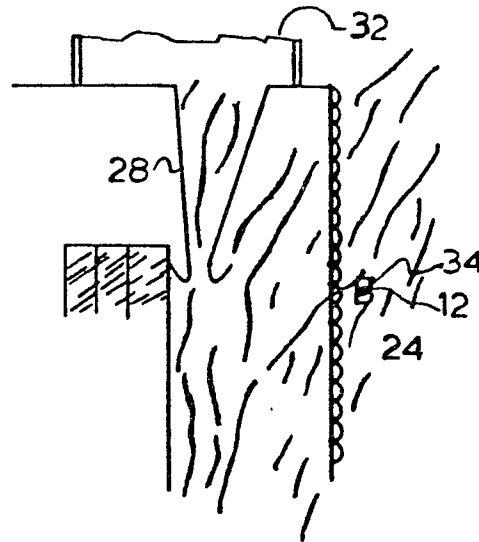
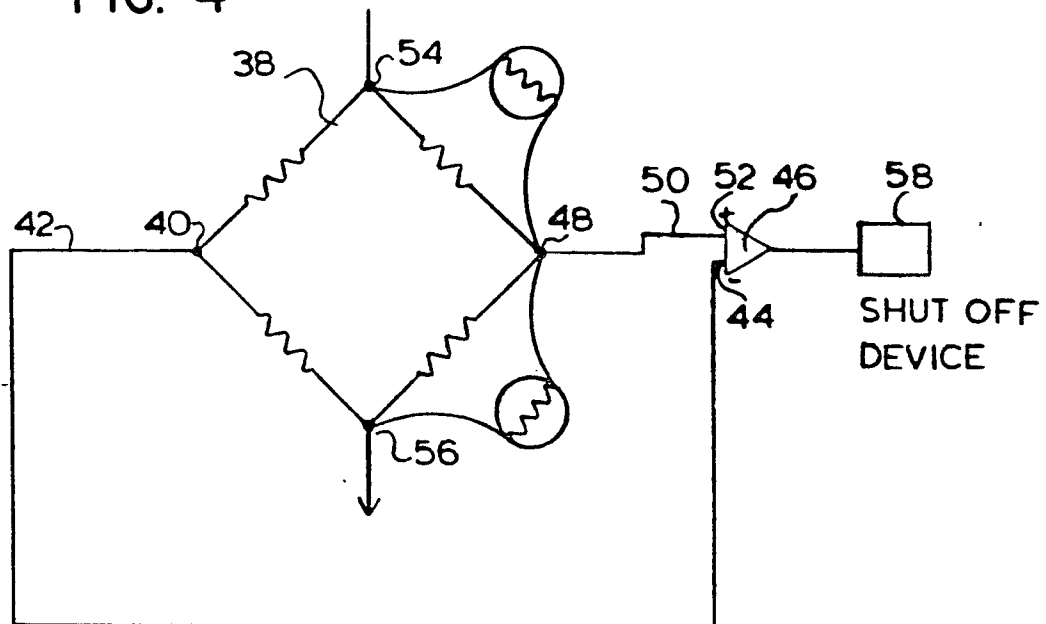


FIG. 4





European Patent
Office

EUROPEAN SEARCH REPORT

0032111

Application number
EP 80 87 0052

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	FR - A - 2 024 094 (VIDALENQ) * page 3, lines 1-13; figures * --	1	F 24 C 3/12
X	DE - B - 1 551 982 (SAUNIER DUVAL) * column 4, claims 1,2; figure 1 * --	1,3,4	
	FR - A - 1 302 578 (THERMOR) * page 2, left-hand column paragraphs 5 and 6; figures 1-5 * --	1	
A	GB - A - 2 020 794 (LEBLANC)		TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
A	FR - A - 2 286 356 (SAUNIER DUVAL) -----		F 24 C F 23 N
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
☒ The present search report has been drawn up for all claims			&: member of the same patent family, corresponding document
Place of search The Hague		Date of completion of the search 16-03-1981	Examiner VANHEUSDEN