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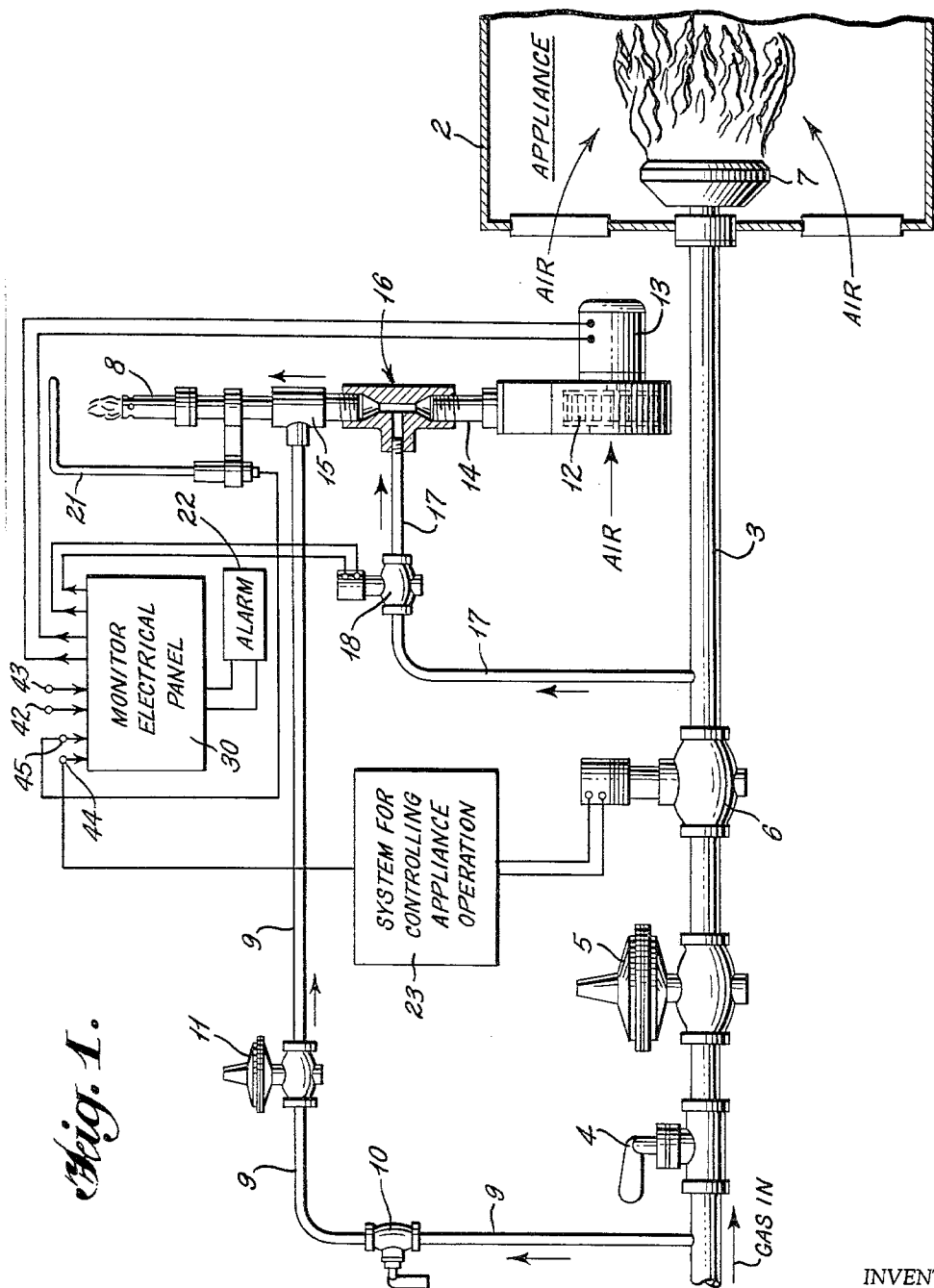
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3,236,284

MONITORING SYSTEM FOR A COMBUSTION APPARATUS AND THE LIKE

Filed Jan. 2, 1963

3 Sheets-Sheet 1



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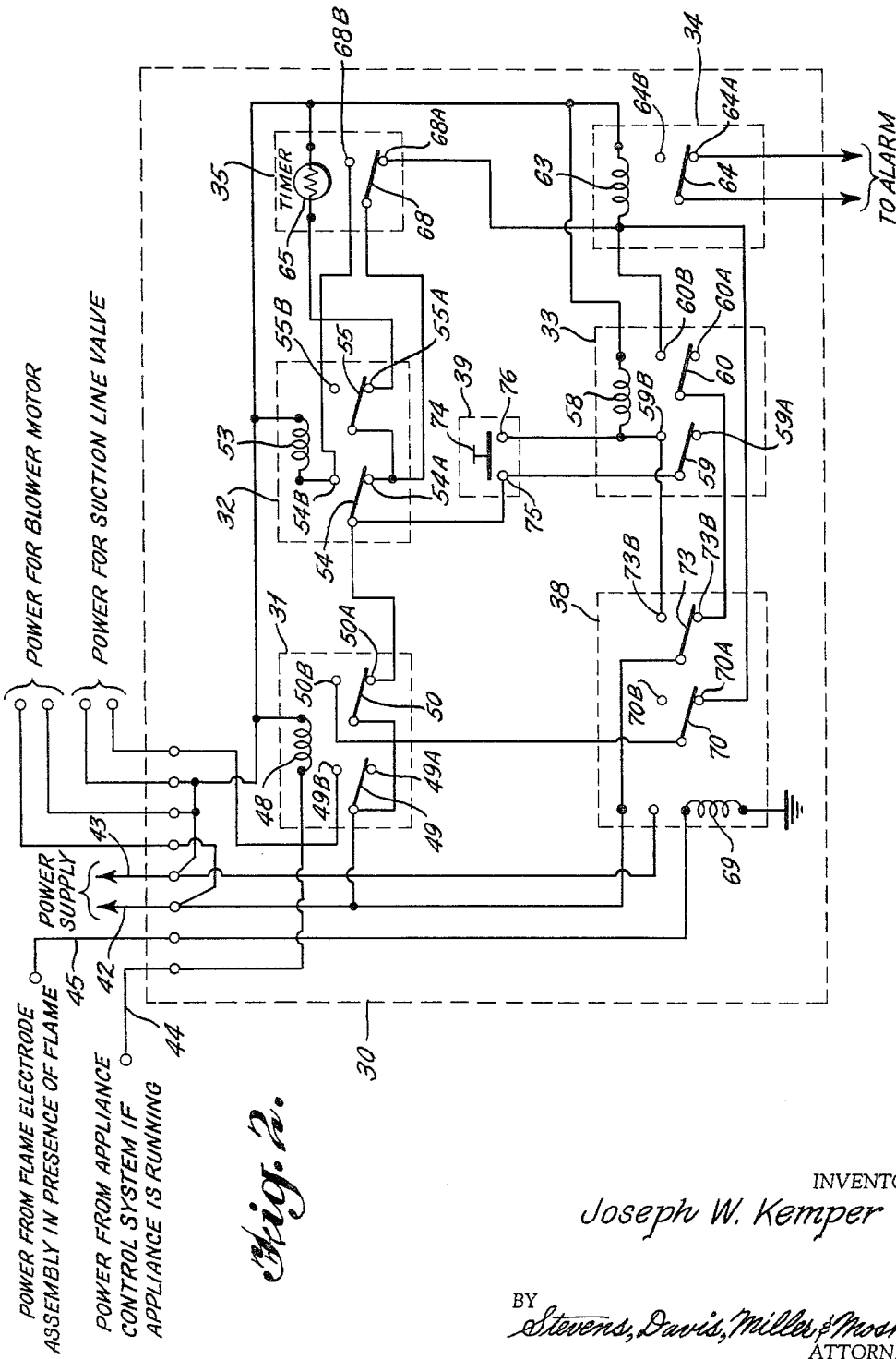
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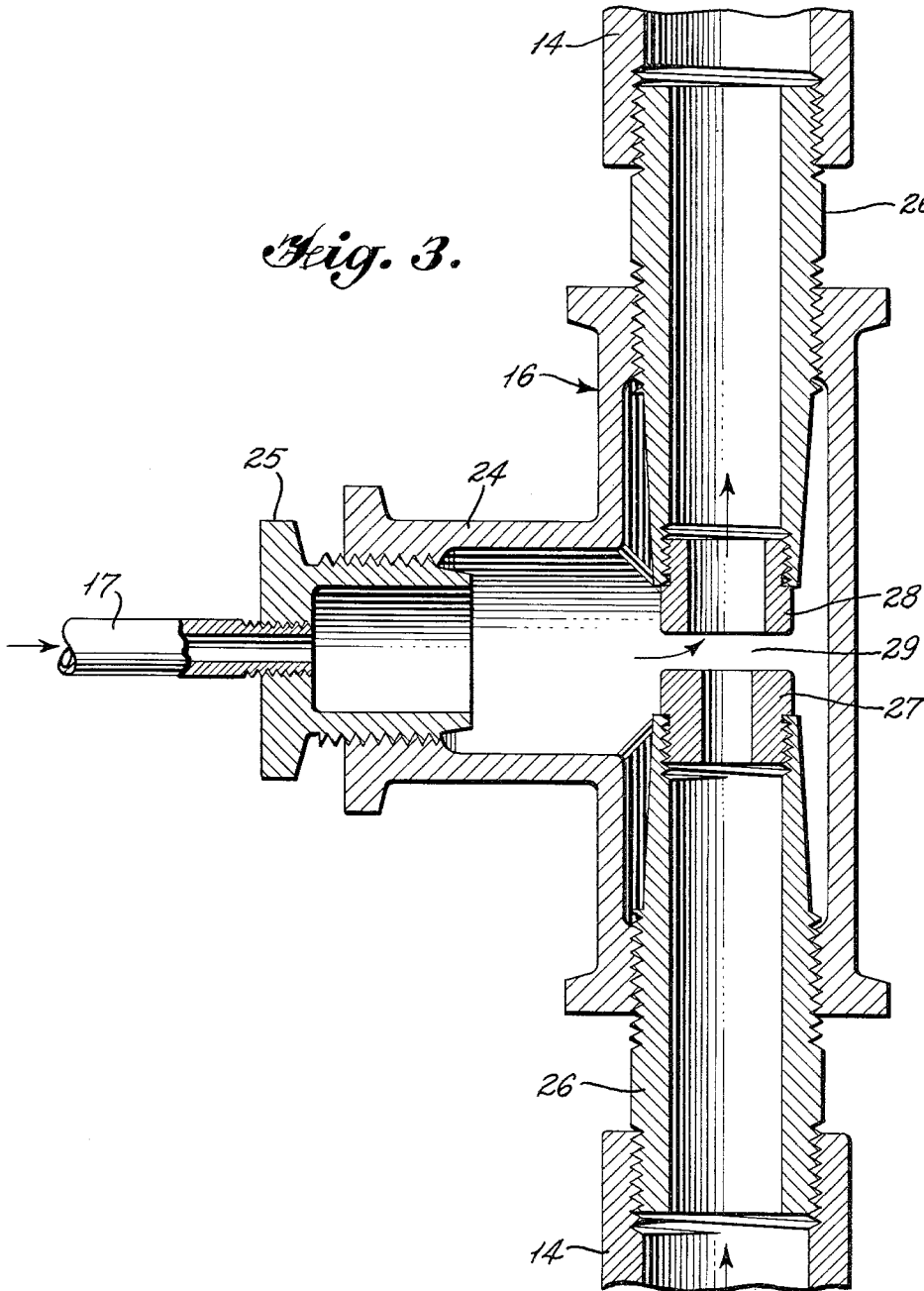
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Fig. 3.



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MONITORING SYSTEM FOR A COMBUSTION APPARATUS AND THE LIKE

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Filed Jan. 2, 1963, Ser. No. 249,035

11 Claims. (Cl. 158-122)

The present invention relates to a combustion apparatus, and, more particularly, to a signal indicating system or safety means for such apparatus.

The invention will be described and illustrated in connection with a combustion apparatus such as a furnace, oven, or the like, which utilizes a combustible vapor or gas to produce heat energy, though it is apparent that the invention is not to be limited thereto, but may be used with various types of appliances and systems. Other applications of the invention would be, for example, checking for sewer gas accumulations escaping into buildings through drainage systems, gas accumulations occurring in contained pockets in structures, but to mention a few.

In the use of combustion apparatus in which a combustible gas such as natural or liquid propane gas is burned in heating boilers, domestic hot water heaters, ovens, incinerators, process boilers and the like, the apparatus or appliance is generally of an automatic recycling type. That is, the equipment is generally in operation for short periods of time after which it is shut down for a short period of time. In other words, it has intermittent operation and the appliance is generally started and stopped at the signal of an automatic controller which may be actuated by temperature, pressure, or the like. This type of appliance is normally unattended by any operating personnel, since it is automatic in operation and, therefore, one hazard encountered by such an appliance is the possibility that during a stand-by period or a period in which it is not in operation, a gas leak may occur thereby resulting in a large accumulation of combustible gas which can result in an explosion if the detection of it is not quickly noticed.

It is an object of the present invention to provide an apparatus provided with protective or safety means for detecting any malfunction of the apparatus to prevent an accumulation of combustible gases in order to prevent any damage or explosion due to such accumulation of gases.

It is another object of the present invention to provide a combustion appliance or apparatus that is fired by a combustible gas with safety means for detecting the leakage of gas into the area of the appliance when the appliance is in a shut-down condition and not in operation.

It is another object of the present invention to provide a monitoring system for a gas-fired appliance with a constant burning pilot or monitoring means in which a portion of the main gas stream of a predetermined value or quantity is passed through the constant burning pilot means, and any increase above the predetermined value will cause an alarm or signaling means to indicate there is leakage of the combustible gas through the main gas stream line when the appliance is not in operation.

It is another object of the present invention to provide a monitoring system for a combustion apparatus in which a constant burning pilot or monitoring means that communicates with the main gas stream or line is also provided with another small gas line in communication with the main gas stream line and the monitoring pilot with valve means therein for sampling and increasing the flow of gas to the monitoring pilot when a gas leak occurs in the main gas supply line to the appliance.

It is another object of the present invention to provide a safety system for the main gas supply line to an ap-

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pliance having a first gas line communicating with the main gas supply line and communicating with a monitoring pilot upstream of the main supply line shut-off valve, and another second gas line communicating with the main gas supply line to the appliance and the monitoring pilot, which second line is located downstream of the main shut-off valve disposed in the main gas line stream for supplying any gas leaking past the main shut-off valve to the monitoring pilot to signal a gas leak in the main shut-off valve or other malfunctions in the system.

It is another object of the present invention to provide a monitoring system for a gas-fired apparatus having a suction gas line and air supply means communicating with a monitoring pilot which maintains a negative or suction pressure on the suction line in order to send any gas leaking past the main shut-off valve of the appliance when it is in stand-by or shut-down operation, to the monitoring pilot so that the system may signal a hazardous condition.

It is another object of the present invention to provide a gas appliance having a main gas supply line with a main shut-off valve therein that is normally open when the appliance is in operation and normally closed when the appliance is shut down and in stand-by condition, and gas pilot means in communication with the upstream side of the shut-off valve, which gas pilot means normally has flowing therethrough a predetermined volume of gas, and another suction gas line in communication with the constant or monitoring pilot that is located downstream of the main shut-off valve, and which suction line is provided with solenoid valve means therein, normally closed when the main gas line shut-off valve is open, and which solenoid valve means is normally open when said main shut-off valve is closed so that any gas leaking past the main shut-off valve will be supplied to the monitor pilot to increase the gas flow thereto above a predetermined value or volume, which will cause an alarm or detector means to signal that there is a gas leak in the main gas line, or that other components of the alarm system are malfunctioning.

It is another object of the present invention to provide a monitoring system for a gas-fired appliance which will indicate a malfunction in the air supply means which operates to suck any gas leaking past the main shut-off valve of the appliance to the monitor pilot which will indicate if the main gas line shut-off valve remains open when the gas appliance burner means is not in operation, and will indicate if the solenoid valve means located in the suction line of the monitoring system fails to open when the appliance is shut down.

It is also an object of the present invention to provide a monitoring system for a gas-fired appliance in which the monitoring pilot system is provided with a monitor pilot that can be the gas pilot for the appliance.

It is another object of the present invention to provide a monitoring system for a gas-fired appliance provided with a constant burning pilot that is always supplied with a predetermined volume of gas when the appliance is turned on, regardless of whether the gas burner means of the appliance is being fired or is in a stand-by condition.

It is another object of the present invention to provide a monitoring system for a gas-fired apparatus having a monitoring system for detecting gas leaks, which monitoring system includes a constant burning pilot connected upstream of the main shut-off valve of the main gas line, and a suction line with solenoid valve means therein in communication with the constant burning pilot and air supply means for creating a negative pressure on the suction line means having venturi means therein for removing any gas which flows into the suction line downstream of the main shut-off valve of the main gas line to the appliance.

Various other objects and advantages of the present invention will be readily apparent from the following detailed description when considered in connection with the accompanying drawings forming a part thereof and in which:

FIGURE 1 is a view of the apparatus embodying the present invention;

FIGURE 2 is a schematic diagram of the electrical circuit of the monitor electric panel embodied in the present invention; and

FIGURE 3 is a detailed view of the vacuum or suction puller means embodied in the present invention.

Referring to FIGURE 1, the reference numeral 2 generally designates a gas-fired furnace or appliance provided with a main gas supply line 3 extending therein for supplying combustible gas to fire the furnace. A manual gas shut-off valve 4 and a pressure regulator valve 5 and a main gas supply shut-off valve 6 are disposed in the gas line 3. The shut-off valve 6 is a solenoid valve and is automatically controlled by the electrical system 23 for controlling the appliance operation. The solenoid valve 6 is normally open when the gas furnace is fired so as to supply gas to the burner 7 in response to temperature, pressure or other similar condition. When the furnace and the burner 7 are in a stand-by condition, that is, when no heat energy is required by the furnace, the electrically operated solenoid gas valve 6, which stops and starts the flow of gas to the gas burner 7, is shut off or closed. Since this is an automatic system, the apparatus is generally unattended by operating personnel. One of the hazards created by the use of the combustible gas for firing the furnace is the possibility that during a stand-by period or a period when the appliance does not call for heat energy, a gas leak may occur in the main gas line shut-off valve 6. It is, of course, apparent that if the valve 6 is not fully closed or there is leakage thereby due to its improperly seating on its valve seat or for any other reason, the gas will be supplied to the furnace 2 and an accumulation of the gas will be hazardous.

The system is provided with a constant burning pilot 8 in communication with the main gas line 3 upstream of or on the inlet side of the main shut-off valve 6 through the small pipe or line 9. The pipe 9 is provided with a manual shut-off valve 10 that is normally in an open position whenever the system is turned on, whether the main gas valve 6 is in a closed or an opened position. This line is also provided with a gas pressure regulator 11 to control the flow of gas to the monitoring pilot 8. The pilot 8 can be the furnace pilot and is supplied with a predetermined value or volume of gas whenever the system is in operation, for example, at the rate of 1 cubic foot of gas per hour.

The air to support combustion is provided by a blower or fan 12, driven by a motor 13, through a pipeline or an air supply line 14 communicating with the fan at one end and the pilot 8 at the other. The air supply line 14 is provided with a T-fitting member 15 that is connected to the constant gas flow line 9 with an orifice therein in the portion of 15 connected to the gas line 9. The air supply line 14 is also provided with another enlarged T connection or member 16 connected to a suction or negative pressure or eduction line 17. The suction line 17 is connected to the main gas supply line 3 downstream of or on the outlet side of the solenoid valve 6 and is provided with a solenoid valve 18 therein. The member 16 is a vacuum or suction puller means, as best shown in FIG. 3, and consists of an outer tubular casing or housing 24 with three internally threaded openings for receiving fittings or adapter bushings therein. The opening at the base of the T is connected to suction line 17 by an externally-threaded bushing 25 secured therein and provided with a smaller threaded opening in its head or flange portion to which the suction line or pipe 17 is threadably secured.

The other two openings have identical elongated sleeve bushings 26 threadably secured therein. Bushings 26 have

their outer ends connected to line 14 externally threaded while their inner ends disposed within housing 24 are internally threaded. The inner ends of bushings 26 are of a diameter substantially less than the inside diameter of housing 24 and gradually taper inwardly. The spacing between the adjacent ends of bushings 26 can be varied by threading them inwardly or outwardly of the housing the distance desired.

An air jet outlet opening or passage is provided by an air jet orifice or nozzle member 27 having external threads on one end secured to the internal end threads of the bushing 26 connected to the air blower side of line 14. The cross-section of the air jet passage is constant and higher pressure air, for example one inch water column, is discharged therethrough into the mixing throat of the device.

The mixing throat is provided by a throat bushing member 28 having an axial bore or passage extending therethrough and with external threads which are secured to the bushing 26 connected to the pilot side of line 14. As FIG. 3 clearly shows the cross-sectional area of throat member 28 is constant and is substantially larger than the cross-sectional area of air jet nozzle 27. These two members are also designed so that their adjacent ends are spaced apart to provide a chamber 29 in communication with the interior of the housing. If the cross-sectional area of the air jet to the throat cross-sectional area is kept in a ratio, preferably of 1 to 1.2, and if the total open area between the end of the air jet and end of the throat is greater than the suction line opening, a vacuum is developed and maintained at a ratio of substantially 1 to 1 relative to the air discharge pressure.

Thus, device 16 is a negative producing device, provided with a fixed air jet discharging air into an adjacent slightly larger air throat, producing a negative pressure or suction in chamber 24 and the interior of the housing, so that as the fan 12 is put into operation, it will cause any gas in the suction line 17 to be pulled therefrom through connection 16 and into the air line 14 to be supplied to the pilot 8, along with the constant supply or flow of gas through the line 9 to thereby increase the volume of gas being consumed by the burning pilot. This will cause the pilot flame to expand in size and make contact with the flame electrode 21 which is disposed in the electrical system to indicate that gas is present in the main gas line 3 downstream of the shut-off valve 6 and is leaking through the valve when it should not be. This malfunction of the main shut-off valve 6 indicating it is either open or it is not properly seated and that gas is passing through the line 3 so as to accumulate in the area of the furnace will be transmitted through the monitor electrical panel 30 to sound an audible alarm 22 or close off a back-up safety valve or other safety means in the system. The reference numeral 23 designates a separate control system for controlling the appliance operation.

Referring to FIGURE 2, the monitor electrical panel 30 is composed of a plurality of switching relays 31, 32, 33 and 34, a motor driven timer 35, an electronic flame detector relay 38 such as the Minneapolis-Honeywell Type R7023A, and a starter switch 39. A suitable source of electrical power, not shown, is connected to supply terminals 42 and 43 of the panel 30. The panel 30 also has a terminal 44 connected to the gas appliance control system 23, and a terminal 45 connected to the flame electrode 21. Electrical current flows between the terminals 44 and 43 through relay coil 48 when the gas appliance 2 is being operated. Electrical current flows between terminal 45 and ground through a flame detector relay coil 69 upon energizing flame detector relay 38.

The relay 31 is composed of relay coil 48, an armature contact 49 that is movable for making a connection with one or the other of two terminals 49A and 49B, and an armature contact 50 that is movable for making a connection with one or the other of two terminals 50A and

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50B. The armature contacts 49 and 50 are shown in their normal positions when the gas appliance 2 is turned "off" and relay coil 48 is de-energized. The armature contacts 49 and 50 are spring biased in their normal positions until the relay coil 48 is energized. They return to their normal positions when the coil 48 is de-energized. The relay 31 has overlap contacts, i.e., the normally open contacts make before the normally closed contacts break.

The relay 32 is composed of a relay coil 53, an armature contact 54 for making a connection with one or the other of two terminals 54A and 54B, and an armature contact 55 for making a connection with one or the other of two terminals 55A and 55B. The armatures' contacts 54 and 55 are shown in their normal positions, relay coil 53 being de-energized. The armature contacts 54 and 55 are spring biased in normal positions until the relay coil 53 is energized, and return to normal positions when the coil 53 is de-energized.

The relay 33 is composed of a relay coil 58, an armature contact 59 for making a connection with one or the other of two terminals 59A and 59B, and an armature contact 60 for making a connection with one or the other of two terminals 60A and 60B. The armature contacts 59 and 60 are shown in normal positions, relay coil 58 being de-energized. The armature contacts 59 and 60 are spring biased in normal positions until the relay coil 58 is energized, and return to normal positions when the coil 58 is de-energized.

The relay 34 is composed of a relay coil 63, and an armature contact 64 for making a connection with one or the other of two terminals 64A and 64B. The armature contact 64 is shown in its normal position, relay coil 63 being de-energized. The armature contact 64 is spring biased in its normal position until the relay coil 63 is energized, and returns to its normal position when the coil 63 is de-energized.

The timer 35 is composed of a motor 65, and an armature switch 68 for making a connection with one or the other of two terminals 68A and 68B. The timer is driven by the motor 65, and is adjustable by means, not shown, for moving switch 68 from terminal 68A to the terminal 68B at the end of a time interval from ten to one hundred eighty seconds, for example. At the moment motor 65 is de-energized, the switch 68 is returned to its normal position by a spring return mechanism, not shown. This normal position is shown in FIGURE 2.

The electronic relay 38 includes a flame relay coil 69, an armature contact 70 for making a connection with one or the other of two terminals 70A and 70B, and an armature contact 73 for making a connection with one or the other of two terminals 73A and 73B. In the event that a flame contacts the flame electrode 21 (shown in FIGURE 1), a rectified current flows through an electronic network, not shown. The rectified current is amplified in the electronic network, after which it energizes the flame relay coil 69 for operating the armature contacts 70 and 73. In FIGURE 2, it is assumed that the relay coil 69 is de-energized and that the armature contacts 70 and 73 are spring biased to the normal positions illustrated.

The starter switch 39 is composed of a starter button 74 which bridges a pair of terminals 75 and 76. A spring biasing means, not shown, urges the starter button to a normal position, whereby terminals 75 and 76 are disconnected.

The purpose of the monitor electrical panel 30 is to actuate the alarm 22 in the event of either a gas leak or a failure of components of the monitoring system to operate properly. Through the use of the motor-driven timer 35 and the interlock relays, after each "on" cycle of the appliance is completed, the control panel causes the alarm to indicate whether or not the system is capable of detecting a gas leak.

The operation of the system is as follows. Initially, the appliance 2 is turned "off," and no power is supplied

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to any of the monitor control panel input terminals 44, 45, 42, and 43. Under these conditions, the armature contacts and switches of the control panel all are in the positions shown in FIGURE 2.

Assuming that the appliance is turned "off" and no power is supplied to input terminal 44, assume further that terminals 42 and 43 are energized by a 120 volt power source, for example, which power source has just been turned "on." Current flows through the four armature contacts 49, 50, 54 and 55 to the timer motor 65. The armature contact 68 does not move immediately because of the delay introduced by the motor 65, and current also flows through the armature contact 68 and the coil 63 of relay 34. Armature contact 64, therefore, moves from its normal position to its other position, thus opening the contacts 64 and 64A to keep the alarm 22 from being actuated.

At the end of the delay produced by timer 35, the armature switch 68 moves from its normal position in contact with terminal 68A to its other position in contact with terminal 68B, whereby the alarm relay coil 63 is de-energized and the relay coil 53 becomes energized. The armature contact 64 of relay 34 returns to its normal position, and the armature contacts 54 and 55 of relay 32 change from their normal positions to their other positions. A holding circuit is created to the relay coil 53, and the power supply to the timer motor 65 is broken. At this moment the armature contact 68 of the timer 35 returns to its normal position, but no power is supplied to the alarm relay coil 63 because the armature contact 54 has been disconnected from terminal 54A.

By pressing the momentary start button 74, power is supplied to the relay coil 58 of relay 33. The armature switch 59 completes a holding circuit for relay 33, and the alarm relay coil 63 receives power from the terminals 42 and 43 through the armature contacts 60 and 73. This opens the armature contacts 64 and 64A and the alarm 22 is inoperative.

The monitor electrical panel 30 is now in the proper sequence for automatic supervision of gas leaks. Gas to the constant burning pilot 8 is turned on, and the pilot is lit. With the monitor panel 30 in a stand-by condition and the main gas appliance 2 "off," the monitoring system is checking and the relays and components are in the following positions:

- (31) De-energized
- (32) Energized (held through its own contacts)
- (35) Motor 65 de-energized
- (38) Power on its two power supply terminals
- (39) In the open position
- (33) Energized (held through its own holding circuit due to the prior action of (39))
- (34) Energized through the panel source of power by current which passes through armature contact 73 and armature contact 60 (which is closed and connects 60B because relay (33) is energized)

With relay 34 energized, the alarm contacts 64 and 64A are disconnected and the alarm 22 cannot operate.

Next, assume that the main gas appliance 2 is turned "on" by the system 23 for controlling the appliance operation. Under this condition, power from a 120 volt supply in system 23 appears across the panel input terminals 44 and 43. Current flows through the relay coil 48, and armature contact 49 moves into contact with terminal 49B for supplying power to the suction line vent valve 18 for closing this valve. The armature contact 50 is disconnected from terminal 50A and is connected with terminal 50B. The relay coils 53 and 58 are de-energized. However, the alarm relay coil 63 remains energized through armature contact 70 and armature contact 50, therefore preventing the alarm 22 from being actuated.

After the demand for heat at the appliance 2 is satisfied, the appliance is turned "off" and power ceases to

be supplied to terminals 44 and 43 of the monitor panel 30. Relay coil 48 is de-energized, whereby armature contacts 49 and 50 return to their normal positions and the suction line vent valve 18 opens. The contacts 50, 50A and 50B have an overlapping action so that the alarm relay coil 63 remains energized and the alarm contacts 64 and 64A are kept open to prevent the alarm 22 from being actuated.

At the moment the appliance 2 is turned "off" and the power supplied to terminal 44 goes off, current passes through armature contacts 49, 50, 54, and 55 to the timing motor 65. During the ten to one hundred eighty second adjustable timing of timer 35, the flame electrode relay coil 69 must be energized momentarily to move armature contact 73 into contact with terminal 73B to reset the holding relay 33. If this sequence of operation does not take place, then there will be a power interruption to the coil 63 of the alarm relay 34 at the moment armature contact 68 is disconnected from terminal 68A, thus actuating the alarm 22.

Momentary energization of the flame electrode relay coil 69 is caused because, during automatic cycling and checking of the monitoring system, a small amount of residual gas must be burned immediately after the main burner "on" cycle, which will flare the constant burning pilot 8 and cause the contacts of the flame detector relay 38 to operate as previously described. If a malfunction occurs, the operating sequence is incomplete and the alarm 22 will be actuated. With the complete sequencing completed, the monitor panel under normal automatic operating conditions will reset itself to the following:

- (32) Energized
- (33) Energized
- (34) Coil 63 energized

In the event that the normally open vent valve 18 does not open when the gas appliance 2 is turned "off," the flame detector relay 38 will not be able to function, thus de-energizing the relay 34 causing the alarm 22 to sound. If gas continues passing through the suction line valve 18 after the maximum timing of the timer 35 is completed, the contacts of flame detector relay 38 will not return to their normal positions and the relay coil 63 will be de-energized and the alarm 22 will be actuated.

During the "off" cycle of the appliance 2, should gas escape into the main gas line supplying the appliance, suction line 17 will pick up a small amount of this gas resulting in expansion of the constant pilot F. Flame contact will be made with the flame detector electrode 21, causing the flame detector relay to move armature contacts 70 and 73, de-energizing the coil relay 63 and actuating the alarm.

In the event that the normally open vent valve 18 does not close during a burner "on" cycle, gas will pass into the monitoring pilot, again energizing the flame electrode relay coil 69, thus opening the power supply connection to the relay coil 63, and the alarm 22 will be actuated.

Another feature of the system is that constant burning pilot 8 depends on 80% of its combustion air from the blower unit 12. In the event that the wheel of this unit becomes loose, power failure occurs, or dirt accumulates on the fan or in the orifices, the constant burning pilot will flare searching oxygen and make contact with the flame electrode 21, again causing the alarm to be actuated.

Since changes could be made in the specific embodiment of the invention as shown and described, and since different words of description of the invention might have been used, it is understood that the invention is limited solely by the scope of the accompanying claims.

What is claimed is:

1. A gas-fired apparatus comprising burner means, a main gas supply line with shut-off valve means therein for supplying fuel to said burner means, constant pilot burner means, gas feed means communicating with said pilot

means and main gas line means on the inlet side of said shut-off valve means for supplying a constant predetermined amount of fuel thereto, air supply means communicating with said pilot means to supply air to support combustion thereto, gas flow producing means for withdrawing gas from said main gas line means on the outlet side of said shut-off valve and delivering said withdrawn gas to said pilot means and alarm means coupled to said pilot burner means and responsive to an increase in gas flow to said pilot means through said gas suction means above said predetermined amount for indicating a malfunction in the flow system.

2. A gas-fired appliance including a main gas supply pipe with a solenoid shut-off valve therein, a pilot burner with a pilot gas pipe connected thereto and to said main gas pipe on the inlet side of said shut-off valve to continuously feed a predetermined quantity of gas thereto, air supply means communicating with said pilot burner to supply air to support combustion, a gas suction pipe connected to said main gas pipe and said air supply means on the discharge side of said shut-off valve, eduction means in said air supply means disposed to withdraw gas from said gas suction pipe and thereby deliver said withdrawn gas to said pilot burner, a solenoid suction valve in said suction pipe for controlling the flow of gas there-through, and means for opening said solenoid suction valve when said shut-off valve is closed and for closing said solenoid suction valve when said shut-off valve is opened, and monitoring means coupled to said pilot burner and responsive to an increase in gas flow above said predetermined quantity to said pilot burner for indicating a malfunction in said shut-off valve.

3. The appliance of claim 2 wherein said air supply means comprises a pipe with a blower fan at one end thereof and said eduction means is a venturi fitting in said pipe and said suction pipe is connected to said fitting.

4. The appliance of claim 3 wherein said pilot gas pipe communicates with said air supply means on the discharge side of said venturi fitting.

5. The appliance of claim 2 wherein said monitoring means includes means to indicate a malfunction in said air supply means.

6. The appliance of claim 2 wherein said monitoring means includes means to indicate a malfunction in said solenoid suction valve.

7. A gas-fired appliance including a furnace, burner means for said furnace and a main gas supply pipe connected to said burner means with a solenoid shut-off valve in said pipe, a pilot burner, an air supply pipe connected to said pilot burner with a blower fan disposed therein, a pilot gas pipe connected at one end to said main gas pipe on the inlet side of said shut-off valve and at the opposite end to said air pipe to supply continuously a predetermined quantity of gas to said pilot burner, a venturi member in said air pipe, a gas suction pipe connected to said main gas pipe on the discharge side of said shut-off valve and connected to said venturi member for withdrawing gas from said main gas pipe and delivering said withdrawn gas to said pilot burner, a solenoid valve in said suction pipe, means for opening said suction pipe valve and maintaining it open when said shut-off valve is closed and for closing it when said shut-off valve is open, and monitoring means coupled to said pilot burner and responsive to a malfunction in said shut-off valve, said fan and said suction valve to thereby signal a malfunction therein.

8. The appliance according to claim 1 wherein said malfunction is a leak in said shut-off valve.

9. The appliance according to claim 7 wherein said monitoring means contains means responsive to an increase in gas flow to said pilot burner at any time other than during a check cycle at the end of each burner demand period.

10. A gas-fired appliance including a furnace, burner means for said furnace and a main gas supply pipe con-

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nected to said burner means with a solenoid shut-off valve in said pipe, a pilot burner, an air supply pipe connected to said pilot burner with a blower fan disposed therein, a pilot gas pipe connected at one end to said main gas pipe on the inlet side of said shut-off valve and at the opposite end to said air pipe to supply continuously a predetermined quantity of gas to said pilot burner, a venturi member in said air pipe, a gas suction pipe connected to said main gas pipe on the discharge side of said shut-off valve and connected to said venturi member for withdrawing gas from said main gas pipe and delivering said withdrawn gas to said pilot burner, a solenoid valve in said suction pipe, means for opening said suction pipe valve and maintaining it open when said shut-off valve is closed and for closing it when said shut-off valve is open, monitoring means coupled to said pilot burner and responsive to an increase in gas flow to said pilot burner, a component failure indicator, a gas leak indicator, timing means within said monitoring means, said timing means activated by a cessation of burner demand whereby said component failure indicator will be energized should there be no change in gas flow to said pilot burner for a predetermined period after a cessation of burner demand and said gas leak indicator will be energized should an in-

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creased gas flow to said pilot burner continue beyond a predetermined time after a cessation of burner demand.
11. The appliance of claim 10 wherein said monitoring means contains a relay responsive to an increase in gas flow to said pilot burner at any time other than the predetermined period following a cessation of burner demand, and said relay energizing a means for indicating component failure.

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