

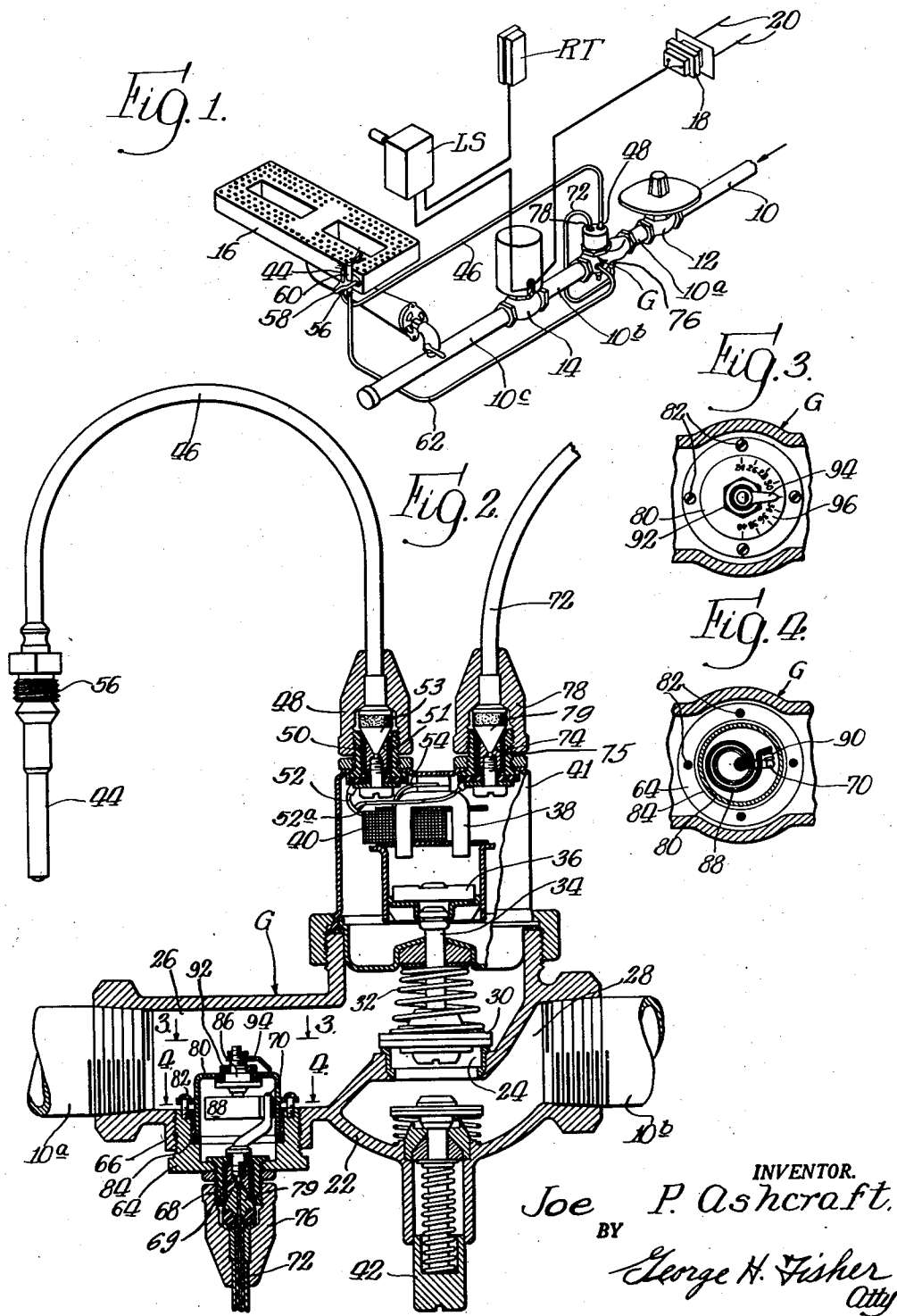
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SAFETY GAS VALVE

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SAFETY GAS VALVE

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My present invention relates to a safety gas valve wherein in addition to the usual protection offered by means of a thermocouple circuit against flame failure, there is also provided a means to close the valve in the event that condensation of the gas becomes imminent.

One object of the invention is to provide means to close the safety gas valve to avoid a fire hazard such as might occur by a slug of liquid being formed by condensation of the gas and passing through the valve to the burner where it might be discharged onto a floor or carpet, and result in a fire.

In the use of hydrocarbon fuels, such as butane and propane that are normally used in a vaporized state as for gas stoves and furnaces where gas mains are not available, there is danger at times of the hydrocarbon becoming condensed into the liquid phase, and being discharged in this phase from the burner which is designed only for utilizing gas. Ordinarily, the safety gas valve is mounted adjacent the burner and the burner is usually at a point spaced some distance from the wall of a building through which the gas supply is piped from an underground storage tank. Other installations have the supply pipe exposed to atmosphere exterior of the building, but usually any gas that is condensed therein will be revaporized by flow through the portion of the pipe within the house before reaching the burner. To guard against any possibility of liquid fuel reaching the burner, however, I have devised my safety gas valve operable to shut off the gas flow in the event that condensation of the gas becomes imminent.

It is, therefore, a further object of the invention to provide a means responsive to a condition of the gas, preferably its temperature, which is in direct relation to the condensation point and pressure of the gas, such responsive means being operable to effect closure of the valve when the temperature reaches that at which the gas condenses, or when the temperature at least approaches the condensation point.

Another object is to provide control means responding to the condition of the gas and operating a short-circuiting switch that can be used in connection with an ordinary pilot safety valve of the type held in open position by a thermocouple current generated in response to operation of the burner.

Still another object is to provide a safety gas valve and a control means therefor to prevent gas flow in the event that condensation becomes imminent, the control means being readily adapted

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for mounting in the valve body and adjustable for different gases and pressures.

Still another object is to provide a simple means of connecting the gas responsive control device with a thermocouple winding in order to short-circuit the winding in response to the control device.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my safety gas valve whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims and illustrated in the accompanying drawings, wherein:

Figure 1 is a respective view of my safety gas valve connected in an automatic burner system to show its environment.

Figure 2 is an enlarged sectional view through the gas valve.

Figure 3 is a sectional view on the line 3—3 of Figure 2, showing a plan view of the gas responsive control device I have devised, and,

Figure 4 is a sectional view on the line 4—4 of Figure 2 showing internal details of the control device.

On the accompanying drawing I have used the reference numeral 10 to indicate a gas supply pipe. The pipe 10 extends to a pressure reducing or regulator valve 12 and after the gas flows through this valve, it flows through a pipe 10^a to a gas valve indicated generally at G. The gas flow is then through a pipe 10^b, a solenoid valve 14 and a pipe 10^c to the burner 16.

In connection with the solenoid valve 14, a room thermostat RT is illustrated for control purposes and a limit switch LS is also shown on the drawing. These are conventional controls in connection with an automatic gas burner installation for house heating, and the like, the current being supplied for the solenoid valve from a transformer 18. The current supply wires for the transformer are shown at 20.

The gas valve G includes a valve body 22 having therein a valve seat 24. The valve body 22 has an inlet 26 and an outlet 28 connected with the pipes 10^a and 10^b, respectively. Normally seated against the seat 24 is a valve plug or disc 30, the seating spring being illustrated at 32. The valve plug has a stem 34 to which an armature 36 is connected. The armature 36 is adapted to engage a core 38 of a winding 40 and to remain engaged therewith due to magnetic attraction when a thermocouple generated current flows through the winding.

Initially the valve 30 may be opened manually

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by pressure inwardly on a starting button 42 which effects engagement of the armature 36 with the core 38 in a manner well known in the art. The button 42 may be released after the thermocouple current commences to flow in the winding 40.

For energizing the winding 40, a thermocouple 44 is provided. A sheathed thermocouple lead 46 extends from the thermocouple 44 to the winding 40 and the sheath is connected by the usual connecting nut 48 with a grounded nipple 50 of a housing 41 for the winding. A wire 52 extends from one end of the winding 40 to an insulated terminal 51, whereas a second wire 54 from the other end of the winding is grounded to the housing 41 and thereby provides an electrical connection with the nipple 50. The inner wire of the lead 46 is connected with a contact element 53 which electrically engages the terminal 51.

The thermocouple has a mounting nut 56 adapted for mounting in a bracket 58 of the burner 16 adjacent the pilot light 60. For supplying gas to the pilot light 60, a copper tube connection 62 is provided with the valve G.

My safety device applied to the valve G for effecting closure of the valve upon gas condensation becoming imminent includes a mounting plug 64 adapted for mounting in a boss 66 of the valve body 22 on the inlet side of the valve seat 24. The plug 64 has therein a terminal 68 mounted in a grounded nipple 69 and suitably insulated therefrom. The terminal 68 has a contact 70 extending upwardly and insulated from the nipple 69. A sheathed lead 72 similar to the lead 46 is provided and has one end connected with the nipple 69, and its other end connected with a nipple 74 by the nuts 76 and 78 respectively. The nipple 74 is grounded on the housing 41 in substantially the same manner as the nipple 50. The terminal 75 is insulatedly mounted in the nipple 74 and is connected by a wire 52^a with the winding 40. Contact elements 79 are provided on the ends of the sheath 72 and connected with a wire that extends through the sheath for affording electrical communication with a terminal 68 and a terminal 75.

A thermostat housing 80 is mounted in the plug 64 as by means of screws 82 and is sealed relative thereto by a gasket sleeve 84. Supported by the housing 80 is a terminal base 86 supporting the inner end of a coiled bi-metal element 88. The element 88 carries a contact 90 for engagement at times with the contact 70. The terminal post 86 is mounted in the casing 80 by means of a lock nut 92. A pointer 94 is mounted on the terminal post 86 and non-rotatable relative thereto. The pointer is adapted for cooperation with a scale 96 (see Figure 3).

The center wire of the lead 72 forms one side of the circuit for the thermostat 88 whereas the other side is grounded from the post 86 through the housing 80, the screws 82, the plug 64, the nipple 69, the sheath of the lead, the nut 78, and the nipple 74 to the housing 41 and thence to the grounded wire 54 of the winding.

Practical operation

In the operation of my safety gas valve, the pilot light 60 is first lighted. After heating the thermocouple 44 so that the winding 40 is energized, the safety valve is manually opened and the armature 36 is then held in elevated position. The push button 42 may now be released. Upon flame failure at the pilot, the winding 40 is de-energized and the armature 36 is released so that

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the spring 32 automatically closes the valve to prevent further flow of gas without combustion. In addition to this safety operation, the thermostat 88 will close upon a certain temperature of the gas affecting the thermostat. For instance, Figure 3 shows the thermostat set for 32° F., which is about the condensation point of butane. Accordingly, the thermostat will close at this temperature, thereby short-circuiting the thermocouple and the winding 40 to thereby de-energize the winding 40 and release the armature 36. The housing 80 is preferably made of thin metal having high heat conductivity to facilitate quick response of the thermostat 88 to the temperature of the gas flowing around the housing. The thermostat can be mounted directly in the gas stream, but it is preferably sealed off by the housing 80 to avoid having switch contacts within the gas stream. The voltage generated by the thermocouple is very slight (usually 10 to 20 millivolts) and therefore not a serious hazard, but in some localities having the switch contacts in the gas stream would not be permitted.

The thermostat is preferably set slightly above the condensation point of the gas so as to make sure that no liquid gas will find its way through the valve. The pressure of the gas must also be taken into consideration as the condensation point varies with pressure. Usually the pressure is substantially constant due to the operation of the reducing valve 12, and therefore the thermostat can be set at an average temperature to take care of the most extreme conditions that might be encountered, and to provide a safety factor where there may be some lag in response of the thermostat to the gas temperature. The thermostat can therefore be utilized to anticipate the formation of condensate and provide for shut-down before condensate appears.

Some changes may be made in the construction and arrangement of the parts of my device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope without sacrificing any of the advantages thereof.

I claim as my invention:

1. A safety gas valve structure comprising the combination with a valve wherein the valve is held open in response to combustion against a resilient closing element by an electrical current flowing through a valve actuating winding of the valve; of means to effect closure of said valve upon the temperature of the gas flowing there-through closely approaching the value at which said gas normally condenses, said means comprising a thermostat normally open contacts in a circuit which upon closure shunts said winding and thereby renders said electrical current ineffective to maintain said winding energized.

2. A safety gas valve comprising a valve normally open in response to combustion and closable upon combustion failure whereby to shut off the flow of gas through the valve, and means to close said valve in the event of condensation of the gas becoming imminent, comprising the location within the inlet section of said valve body of means responding to the temperature of the gas flowing therethrough and effective to close said valve when the temperature closely approaches that at which said gas condenses within a temperature range of from 24° F. to 40° F.

3. A gas safety valve comprising a biased closed valve, condition responsive means for hold-

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ing the valve in open position, and temperature responsive means operatively associated with said holding means and exposed to gas flowing through said valve so as to cause said holding means to release said valve upon the gas lowering to a predetermined temperature slightly above its condensation temperature.

4. A gas safety valve for use with gas burners comprising a valve body having an inlet and an outlet, a biased closed and electrically controlled valve therein, condition responsive means for controlling energization of said valve for holding it in its open position when energized, and a temperature responsive means operatively associated with said valve and removably mounted in a wall of the valve body so as to be responsive to the temperature of gas within said valve body, said means having a thermostat operable at a temperature slightly above the condensation temperature of said gas to render said condition responsive means inoperable.

5. A gas safety valve comprising a valve body having gas inlet and outlet passages, a valve normally biased closed, condition responsive electrical means on the valve body for holding said valve in an open position and temperature responsive means having electrical contacts and a protective gas-contacting shield therefor detachably mounted in the wall of said inlet passage, said temperature responsive means being operatively associated with said holding means to cause

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it to release said valve when the gas lowers to a temperature slightly above the condensation temperature of the gas.

6. A gas valve comprising a biased closed valve, means for holding said valve open, and means positioned to be responsive to the temperature of gas within said valve, said last mentioned means being connected with said holding means and being so calibrated as to cause said holding means to release said valve when the temperature of the gas closely approaches its condensation temperature.

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