

Automated Gas Line Shut Off Mechanism Using Solenoid Operated Valve and Gas Leak Detector (At the Event of Gas Leakage in PNG Line)

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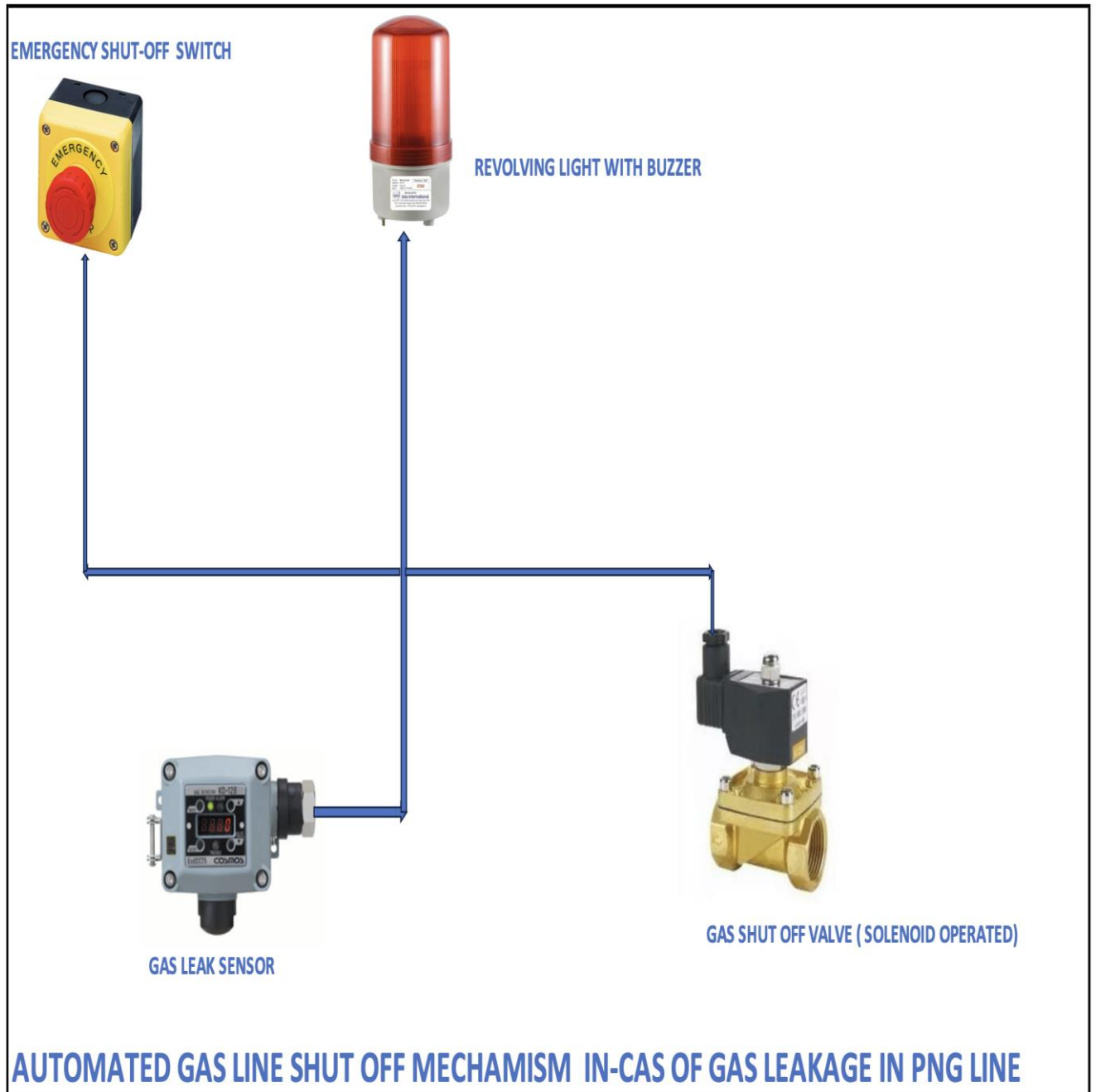
Abstract

Gas leaks that cause deadly flames have become a major issue in homes and other places where domestic gas is handled and utilized. Gas leaks cause a variety of mishaps that result in financial damage as well as personal injuries and/or loss. The project's goal is to create a system that detects gas leaks and notifies the subscriber through alarm and status display, as well as shutting off the gas supply valve as the main safety precaution. The turning off of the supply valve prevents further gas flow to the cooker, preventing a fire breakout caused by an attempt to ignite the cooker. The device, which functions more like a first-aid kit, utilizes a usually closed solenoid valve to shut off the gas valve before asking for assistance via visual display and loud alert to anyone in the vicinity. The system is clever in that it does not cause a loud nuisance by constantly sounding the alarm, but rather the siren stops beeping once the concentration of the gas in the atmosphere after leaking falls below the predetermined value and the valve is opened again for regular operations. This effort will reduce injuries and losses caused by explosions caused by gas leaks, as well as enhance the safety of people and property while utilizing home cooking gas.

Introduction

Gas leakage is an important issue that is now seen in a number of locations, including homes, businesses, vehicles, etc. Dangerous events due to gas leaking have been reported. Liquefied oil gas (LPG) is an inflammable hydrocarbon mixture that is used for a wide variety of applications since it is of high temperature, less smoke, less soot and less environmental effects., including houses, hostels, factories, cars, and vehicles as fuel. LPG is very flame retardant and may catch fire even if it is a great distance from the source of the leak. The energy source consists primarily of the highly fuel-efficient propane and butane chemical molecules. The gases are very inflammable. LPG is used mostly for cooking in homes. The dumping gases may create an explosion when a leak occurs. Leaks in gas lead to a range of malfunctions that entail material loss and harm to people. Home fires have been increasingly widespread in recent years, putting human lives and property in greater danger. Physical properties like toxicity, flammability, and so forth determine the hazards of explosion, fire, and asphyxia. In recent years, the frequency of deaths resulting from gas cylinders has increased. The gas disaster in Bhopal is an example of a gas leak. The explosions have been caused by poor cylinders, outdated valves, frequent examination of gas cycling systems, worn-out regulating systems and an incomprehensibility of gas cylinder management. Gas leaks must thus be detected and controlled to safeguard humans. LPG includes the odorant that may detect leakage, such as ethane thiol. However, some people with weak olfactory senses may not be able to rely on this buildup. For the protection of humans from the dangers of gas leaking, a gas leak detector is necessary. In this article, the user is informed of a gas leak by SMS and the power supply is disabled. Real-time Leak detection and gas surveillance system The gas leak is controlled via an exhaust ventilator and monitored. The amount of LPG is also constantly monitored in the cylinder, according to the technique recommended, where the gas sensor detects leakage and the audible and visual results are generated. It provides a software and hardware design methodology. In the present method, several gas detecting technologies are used. A cost- sophisticated sensor based gas leak detection, warning, and control system are proposed and discussed in this article. It is highly efficient, easy to use, portable, small, and economical in size.

Proposed System Layout



HARDWARE COMPONENTS

The suggested system is made up of below 7 core items that are used to prepare the system operational.

user-friendly. These are some examples.

1. Gas Leak detector (catalytic combustion sensor)
2. Gas shut- off valve (Solenoid operated -230VAC)
3. Revolving tower light with Buzzer
4. Emergency shut-off switch
5. wiring & terminals.
6. Mounting plate
7. Gas sampling bottle (for functional checking of the system.

1. Gas Leak detector (catalytic combustion sensor) :

Catalytic combustion sensors are classified according to the method employed to measure combustible gas, and they have come to be widely used to prevent methane/LPG explosions Petrochemical industries & other industries since long, they have been improved considerably and are now more widely used throughout various industrial sectors as well as domestic PNG lines.

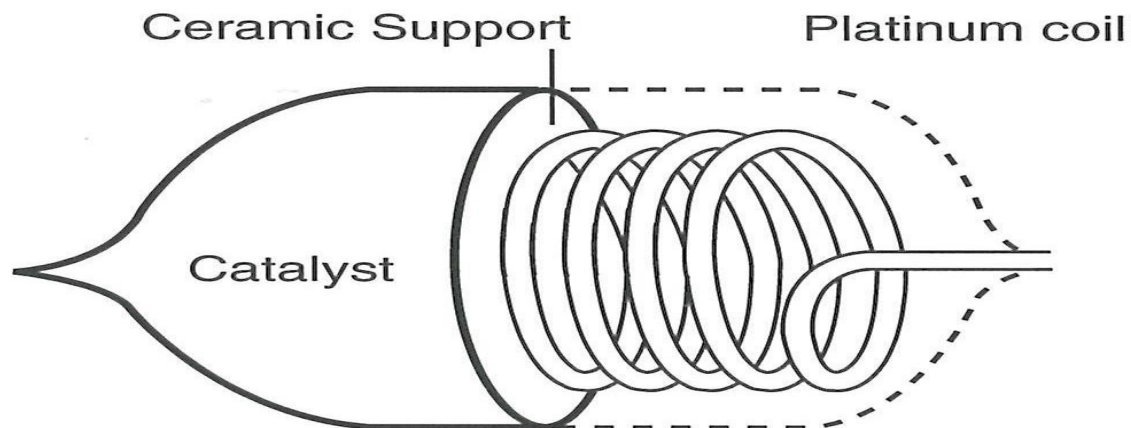
Advantages :

- Accuracy and reproducibility are excellent
- Low power consumption allows devices to be more compact
- Hardly affected by ambient temperature and humidity
- The output curve (to just short of the explosion threshold) is almost a straight line

Configuration detector element

The sensor consists of a detector cell and a reference cell. The detector cell basically is a platinum wire coil ($\phi 0.05\text{mm}$ or less) to which the carrier is attached, and it is coated with an oxidization catalyst such as alumina. When the powered sensor is exposed to combustible gas, the gas will burn. The reference cell is essentially an identical platinum coil, that has been treated to prevent combustible gas from igniting upon contact. (Since both cells become extremely hot during use which could ignite the combustible gas, they are enclosed in an explosion-proofed protective sintered metal and stainless steel 200-mesh netting to prevent sparking).

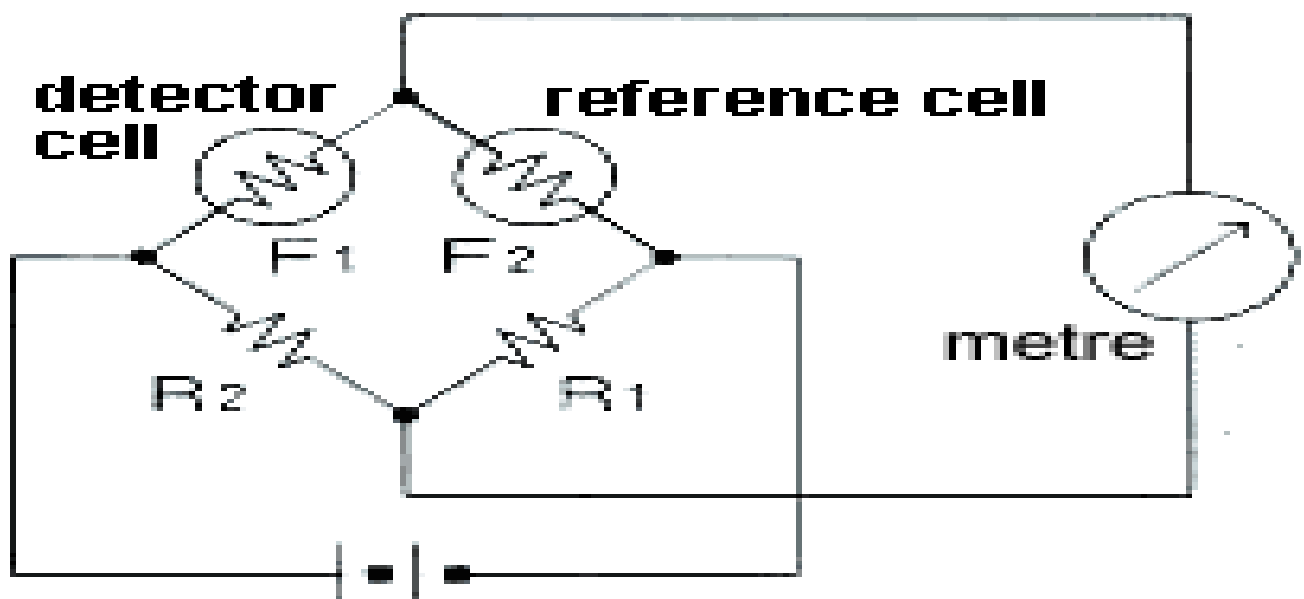
Structure of Detection Element



Function principle

The gas concentration is measured with a Wheatstone-Bridge circuit as in the diagram. The detector cells F1 and F2 are designed to have equal electrical resistance when no combustible gas is present in the sampled air. Therefore, in a state where $F1 \times R1 = F2 \times R2$, the bridge circuit will be in equilibrium, and current will not flow through the metre. However, when air containing combustible gas burns and contacts the detector cell, the electrical resistance increases with the combustion heat, and equilibrium of the bridge circuit is lost, with current flowing through the metre virtually proportional to the combustible gas concentration below the lower explosive limit.

Function principle of sensor



Sensitivity to combustible gas

The sensitivity of a contact combustion type sensor shows almost equal sensitivity to all concentrations below the LEL (lower explosion limit) threshold of virtually all combustible gases (or mixed concentrations thereof). Therefore, almost all combustible gases can be measured with any measuring device that can be calibrated with a scale having the LEL as 100%.

For PNG detection the LEL is 5% volume & we have selected the detector for detection of PNG.

2. Gas shut- off valve (Solenoid operated -230VAC) : A gas solenoid valve is an electromechanical valve designed to control the flow of gas. The valve translates electrical impulses into mechanical movements to open and close the valve. The valves in this category has a brass or stainless-steel housing and NBR (nitrile rubber) seal. These materials are durable and are high temperature and pressure resistant. The valves are normally closed (NC) which means it remains in closed position when no power is applied. This category contains valves that are suited for low pressure inert gases. For applications that require an approval, such as for domestic gas appliances.

3. Revolving tower light with Buzzer :

Revolving tower lights with buzzer is used for visual and audio alarm in case of gas leak occur near to the gas leak sensor .

At the event of gas leakage and if the gas leakage concentration reaches above the set alarm value (25%LEL) the gas alarm relay of the detector will actuate & the revolving tower light /buzzer will start alarming.

This will automatically reset in-case of gas leakage is stopped.

4.Emergency shut-off switch: An emergency switch is provided in the system to closed the gas line solenoid valve for maintenance purpose or to stop the gas line by pressing emergency shut-off valve in case of any abnormality at the gas system.

RESULTS & CONCLUSION

Gas leaks cause serious mishaps that result in material losses and human injuries. Gas leakage is caused mostly by poor equipment maintenance and a lack of public knowledge. As a result, detecting LPG leaks is critical for avoiding accidents and saving lives.

This project described a method for detecting, alerting LPG leaks & automatically stopping gas line When LPG leakage is detected, this device activates an alarm light and a buzzer to warn people.

A manual emergency stop switch is also provided to stop the gas line in case of any visual abnormality in the system.

As a result, detecting GAS leaks is critical & very useful for avoiding accidents and saving lives.