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Highly Secured LPG Refrigeration System

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Abstract: ***In many parts of the country and the world, where food and medicine can be stored, there is still a lack of continuous electricity supply. LPG is made up of 24.4 percent propane (C3H8) (R-290), 56.4 percent butane (C4H10) (R-600), and 17.2 percent isobutane (C4H10) (R- 600), all of which have a very low boiling point (lower than 0 degree). LPG is less expensive and has no ozone depletion potential, making it a good choice for the environment (ODP). CO2 and H2O are the combustion components of LPG. The evaporator reached a temperature of -10 degrees Celsius. The COP of a refrigerator, according to experiment, is 2.25.***

Keywords: LPG Refrigerant, Solenoid Valve, Refrigerating effect, COP, Capillary tube.

I. INTRODUCTION

In a general sense, the term "refrigeration" refers to the process of removing heat (i.e. cooling) from a substance. It also includes the process of limiting and removing waste. It also includes waste reduction and elimination techniques. In general, keeping one's body temperature below that of the surroundings. For example, if a room (such as cold storage) is to be held at -2 C, we must constantly remove heat that flows in by leakage through the walls as well as heat that is carried in with the articles deposited after the temperature is reduced to -2 C. As a result, heat is virtually pumped from a lower temperature to a higher temperature in a refrigerator. The cooling system is in good shape. Since the mid- nineteenth century, the man has known a hundredth A few theories were established by scientists at the time to get some fun from stray machines However, it paved the way for future developments. The method of attracting scientists' attention so that proper research can be carried out study and analysis. They were able to create a fairly efficient machine for refrigeration jobs by the end of the nineteenth century. However, the science of refrigeration reached its pinnacle with the development of powerful rotary compressors and gas turbines. Huge quantities of snow were dumped into storage pits dug into the field and insulated with wood and straw by the Hebrews, Greeks, and Roman Ancient Egyptians filled earthen jars with boiling water and put them on top of their roofs, exposing the jars to the cool night air. Evaporative cooling was used in India. A liquid spread rapidly as it vaporizes easily. The Kinetic energy of rising vapor modules is suddenly increased, and this increase is derived from the vapor's intermediate surroundings. Ancient Egyptians boiled water in earthen jars and put them on top of their roofs, exposing them to the cool night air. In India, evaporative cooling was used. Since it vaporizes quickly, a liquid spread quickly. Rising vapor modules' kinetic energy is unexpectedly increased, and this increase is extracted from the vapor's intermediate surroundings.

A. Objectives

1) To receive the LPG refrigerant's characteristics and benefits.
2) Calculate the COP of a refrigerator that uses LPG as a refrigerant.
3) To benefit from the cooling effect without incurring any costs by obviating the need for a compressor.
4) To develop an environmentally friendly refrigeration device using technology that reduces the use of depleting refrigerants.
5) To distinguish between the current existing refrigerator cost and estimated cost of LPG refrigerator.

B. Comparison With Domestic Refrigeration

The average cost of a domestic refrigerator is $2.95, which is less than the cost of an LPG refrigerator. In comparison to LPG refrigerators, domestic refrigerators required a higher input capacity. In addition, domestic refrigerators have more moving parts, which are not environmentally friendly. Domestic refrigerators demand more maintenance and are noisier to operate.

C. Scope Of Work

Our primary goal is to research and analyze the Vapor Compression Refrigeration method. An LPG cylinder is used in place of the compressor and condenser. LPG has a high-pressure energy since it can be compressed to 12.5 bars, and therefore it can be used for refrigeration. The cost of using this LPG device is also very low.

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D. Refrigerant

Until recently, the most commonly used refrigera nts were a group of halogenated hydrocarbons so ld under the brand names freon, genetron, arcton, isotron, frigen, and others. These are either met hane- or ethane-based, with chlorine or fluorine atoms replacing hydrogen atoms. Methane-based compounds have a two-digit number, with the first digit minus one indicating the number of hydrogen atoms and the second digit indicating the number of fluorine atoms, with the remaining atoms being chlorine. As a result, the compound is designated as CCI,F2, dichlorodifluoromethane methane. Similarly, R-22 is CHCIF, monochloro-difluoro methane; R-50 is CH, methane; R-10 is ccl, carbon tetrachloride, and so on.

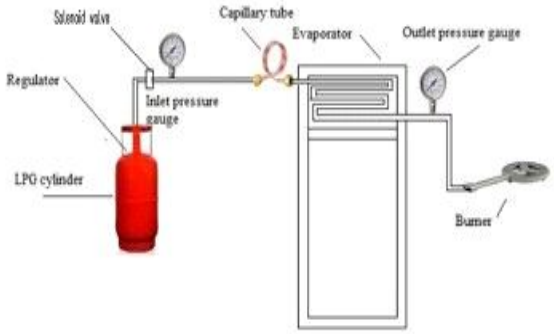
If the refrigerant is based on ethane, it is given a t hree-digit number, with the first digit always being 1, the second digit minus one representing the numb er of hydrogen atoms, and the third digit represe nting the number of fluorine atoms, with all other atoms in the hydrocarbon being chlorine

II. EXPERIMENTAL SETUP

A. Working Principle

The basic concept behind LPG refrigeration is to trap heat using the evaporation of an LPG. Under high pressure, LPG is contained in the LPG cylinder. When the regulators' gas tanks are opened, high-pressure LPG passes through the gas pipe. This LPG is carried in a capillary tube by a high-pressure gas pump.

At the capillary tube, high-pressure LPG is converted to low-pressure LPG while the enthalpy remains constant.



Low pressure LPG is passed through the evaporator after passing through the capillary tube. LPG is converted into a low-pressure, low- temperature vapor in the evaporator, which absorbs heat from the chamber. As a result, the camber cools down. As a result, we can get a cooling effect in the refrigerator. After passing through the evaporator, the burner pushes low-pressure LPG through the tubing. In addition, the low pressure of LPG may be used in the burning process. A high- pressure gas loses pressure and undergoes a phase shift from gas to liquid by absorbing latent heat.

B. Safety Measures

1) *Solenoid Valve:* A solenoid valve is a valve that is regulated by electricity. The characteristics of the electric current they use, the strength of the magnetic field they produce, the mechanism they use to regulate the fluid, and the form and characteristics of fluid they control all vary between solenoid valves.
2) *Types Of Solenoid Valve*

a) *Solenoid Valve (Normally Open):* A 2-way, usually open solenoid valve has two pipe connections: a cavity port for inlet and a stop port for outlet. The stop port is open in its normal de-energized state, and media flows into the cavity port and out the stop port. The plunger seals the orifice when the valve is energized, preventing flow through the valve. Turn off the power. The orifice opens and flow through the valve resumes.

b) *Solenoid Valve (Normally Closed):* One way to regulate the flow of liquid or gas is to use a usually closed solenoid valve. The magnetic field causes the plunger to rise until the usually closed solenoid valve is driven or energized. This opens the valve and allows liquid or fluid to flow through it.

3) *Type Of Solenoid Used In Our Project Solenoid Valve (Normally Open):* Normally open (NO) means that the valve is open and fluid flows from the inlet to the outlet and the exhaust port is blocked when the coil is de-energized. When the coil is energized, the inlet port will close and the flow path from the outlet to exhaust is opened.

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III. AUTOMATIC SOLENOID VALVE

A. Program Circuit – ARDUINO UNO

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

B. MQ2 Sensor

The Grove - Gas Sensor (MQ2) module is useful for gas leakage detection (home and industry). It is suitable for detecting H2, LPG, CH4, CO, Alcohol, Smoke or Propane. Due to its high sensitivity and fast response time, measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted by potentiometer.

C. Working (Automatic Solenoid Valve)

As per the working of automatic solenoid valve, the MQ2 sensor detects the leakage. The signal from MQ2 sensor is sent to the Arduino uno which captures the pulses. This signaling is sent in a split of a second which triggers the microcontroller to send pulses to the solenoid valve. Thus, shutting down the solenoid valve and cutting the supply out. This stops the further advancing of the LPG gas as the solenoid valve holds it in and does not let it pass through. Hence, avoiding any serious casualties.

D. Actual Project

IV. RESULT AND CONCLUSION RESULT

As a result we get a C.O.P around 6.12 which is bearable and gives proper cooling. LPG is not harmful to the environment and hence it does not generate harmful gases even after existing into the atmosphere.

V. CONCLUSION

This “Design of Highly Safe Refrigeration System Using LPG” reveals that LPG can be lower cost than other refrigerants, and it has the benefit of providing a cooling effect without the use of electricity. This project is also eco-friendly as it does not affect the ozone layer unlike other refrigerants.

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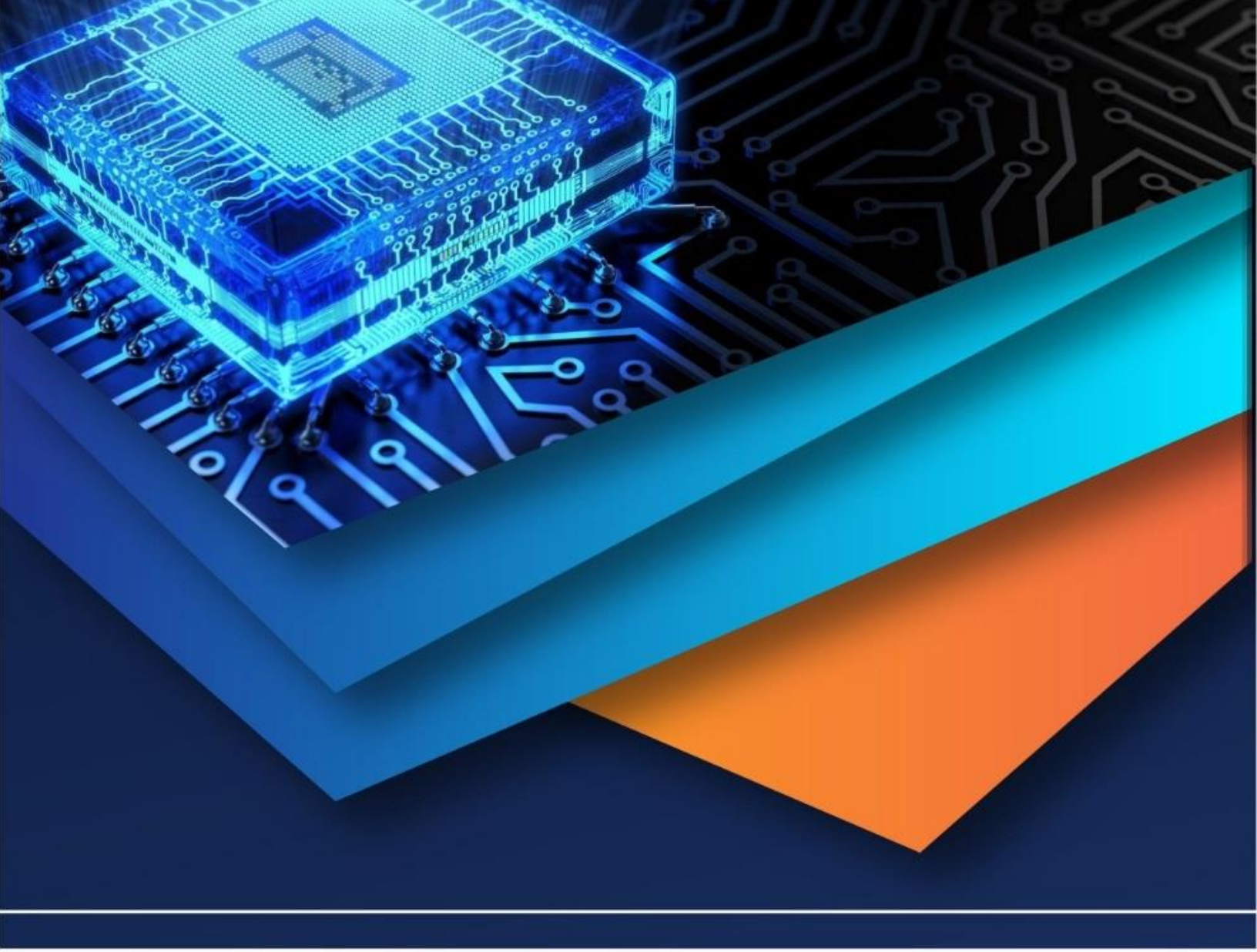

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