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NO COST REFRIGERATION WITH LPG GAS

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Abstract - Supply of continuous electricity is still not available in several areas of the country and the world. At such places, this work will be helpful for refrigeration of food, medicines, etc... This paper investigates the result of an experimental study carried out to determine the performance of domestic refrigerators. In this project a new concept for air- conditioning systems by using Liquefied Petroleum Gas (LPG) is proposed. In this work we have investigated the performance of a refrigerator by using LPG as refrigerant as LPG is locally available and is easy to transport anywhere. LPG is a byproduct in petroleum refineries and comprises 24.4% propane, 56.4% butane and 17.2% isobutene which have very low boiling point (lower than 0°C). The purpose of using LPG for refrigeration is because it is environment friendly, since it has no ozone depletion potential (ODP =0) and the combustion products of LPG are CO2 and H2O. In this project we have designed and analyzed a car ac using LPG as refrigerant. LPG is available in cylinders at high pressure. When this high pressure LPG is passed through a small internal diameter of the capillary tube, the pressure of LPG gets dropped due to expansion and phase change of LPG occurs in an isenthalpic process.

***Key Words*: Refrigerators, LPG, Refrigerant, petroleum, Capillary tube etc**

1. INTRODUCTION

Due to the huge demand of electricity over the world, we think of recovering the energy which is already spent but not being utilized further, to overcome this crisis with less investment. The climatic change and global warming demand accessible and affordable cooling systems in the form of refrigerators and air conditioners. Annually Billions of dollars are spent in serving this purpose. Hence forth, we suggest COST FREE Cooling Systems. Although government agencies are not able to continuously supply a major portion of electricity in both the urban as well as in rural areas. Still the people in these regions require refrigeration for a variety of socially relevant purposes such as cold storage or storing medical supplies and domestic kitchens this project has the novelty of using LPG instead of electricity for refrigeration. This solution is convenient for refrigeration in regions having scares in electricity. It works on the principle that during the conversion of LPG into gaseous form, expansion of LPG takes place.

1.1 Problem statement

LPG which is stored in storage devices like cylinders at high pressure is extracted. Its pressure and flow rate is controlled by a valve connecting it to the capillary tube at requisite quantity. Evaporator converts it from liquefied state to gaseous state and expands, so it absorbs heat in the form of latent heat due to this process. However heat from the surroundings is absorbed, so a cooling effect is produced. This results in calculating the cooling effects at different flow rates of LPG gas.

1.2 Objectives

1) To identify the form of residual waste in traditional Refrigeration system.
2) Compare the important characteristics between LPG Refrigeration system and traditional refrigeration system.

3) To distinguish between the current existing refrigerator Cost and estimated cost of LPG refrigerator.

4) The performance of existing refrigerator and LPG Refrigerator is to be compared.

5) To determine the cop of refrigerator using LPG as refrigerant

2. Scope

1) The future scope of this project is to focus on implementation of the project in the restaurant and community hall for preserving vegetables, dairy products with the refrigeration, where it serves the purpose of preservations.

2) This kind of system can be implemented on the food trucks as well where it can store in various quantities .

3) To create working model for LPG refrigeration.

Future scopes of the LPG refrigeration system

2.1 Selection of parts:

1) **LPG cylinder** : LPG is a mixture of butane and isobutene. It is generally stored at 12.7 bar for house hold purpose cylinder. By using a suitable regulator LPG is sent into capillary tube. LPG is used as a fuel for domestic, industrial, horticultural, agricultural, cooking, heating and drying processes. LPG can be used as an automotive fuel or as a propellant for aerosol, in addition to other specialist applications LPG can also be used to provide lighting through the use of pressure lanterns.

Fig -1: LPG cylinder

2) **Capillary tube**: The capillary tube is the commonly used throttling device in the domestic refrigeration.

The capillary tube is a copper tube of very small internal diameter. It is of very long length and it is coiled to several turns so that it would occupy less space.

The internal diameter of the capillary tube used for the refrigeration applications varies from 0.5 to 2.28 mm (0.020 to 0.09 inch).

The capillary tube is shown in picture. The decrease in pressure of the refrigerant through the capillary depends on the diameter of capillary and the length of capillary.

Smaller is the diameter and more is the length of capillary. More is the drop in pressure of the refrigerant as it passes through the capillary tube.

3) **Evaporator**: The evaporators are another important parts of the refrigeration systems. Through the evaporators the cooling effect is produced in the refrigeration system. It is in the evaporators when the actual cooling effect takes place in the refrigeration systems.

For many people the evaporator is the main part of the refrigeration system, consider other part as less useful.

The evaporators are heat exchanger surface that transfer the heat from the substance to be cooled to the refrigerant, thus removing the heat from the substance.

Fig 3: Evaporator

3) **Pressure gauges**: Many techniques have been developed for the measurement of pressure and vacuums. Instruments used to measure pressure to both ends. Two swiveling connection nipples press these balls against the seating of the connecting hole and thus sealing against gas leakage. All pipes are pressure tested to 100 M Pa (14,500 psi) over recommended working pressure are called pressure gauges or vacuum gauges.

3. Design and specification of components:

6) **High pressure regulator**: This type of regulator is used to send high pressure gas from the cylinders. These are mainly used in functions to Bhatti stoves.

Fig 6: Pressure regulator

Fig 4: Pressure gauges

5) **High pressure pipes:** The range of high pressure pipes covers most applications where there is a requirement to transfer gas at high pressure.

They consist of a steel pipe with a steel ball fitted

Design of capillary tube : The capillary tube is a fixed restriction-type device. It is a long and narrow tube connecting the condenser directly to the evaporator. The pressure drop through the capillary tube is due to the following two factors: 1. Friction, due to fluid viscosity, resulting in frictional pressure drop. 2. Acceleration, due to the flashing of the liquid refrigerant into vapour, resulting in momentum pressure drop. Design parameters for capillary tube are: Cylinder size = 14 kg,

Dcylinder = 295 mm dcapillary = 1.05mm

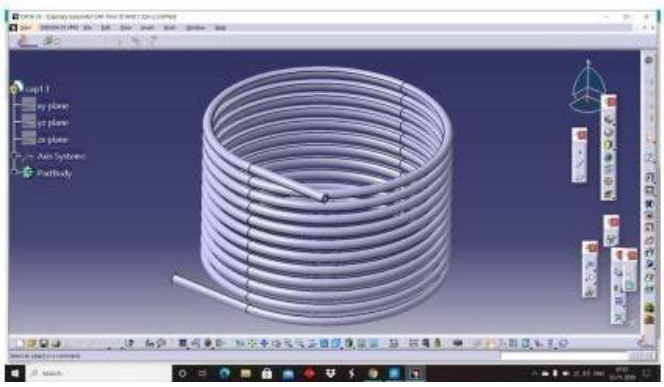

Fig 1 : Design of capillary tube on CATIA

Design of evaporator : The evaporator is the component of a refrigeration system in which heat is removed from air, water or any other body required to be cooled by the evaporating refrigerant. In experimental setup plate and tube type evaporator has been used because it provides a gentle type of evaporation with low residence time. It also preserves the food and other products from bacterial attack and requires low installation cost.

Dimensions	Refrigeration effect	Material	Insulation Material
300×200×150 mm	0.262 KW	Aluminium	PUF

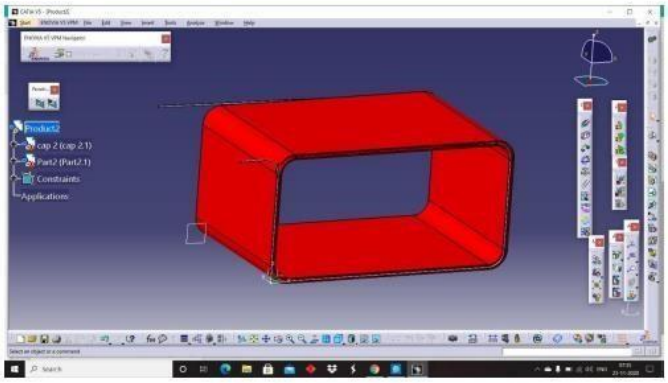

Fig 2 : Design of Evaporator on CATIA

4. CONCLUSIONS

1. Propane is an attractive and environmentally friendly alternative to CFCs used currently.
2. Mass flow rate increases with increase in capillary inner diameter and coil diameter whereas mass flow rate decreases with increase in length. It was observed that the COP of system increases with similar change in geometry of capillary tube.
3. Cooling capacities were obtained order of about three- to four fold higher for LPG than those for R- 12. Capillary tube. COP of LPG refrigerator was higher than that of R134a by about7.6%. LPG seems to be an appropriate long-term candidate toreplaceR134a in the existing refrigerator, 4. High COP values were obtained No operation problems have been encountered compressor. The use of LPG as a replacement refrigerant can contribute to the solution of (ODP) problem and global warming potential.

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