EXPERIMENTAL STUDY OF TURBULENT FLOW IN VAPOR COMPRESSION REFRIGERATION SYSTEM

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Abstract : A method and apparatus for improving refrigeration and air conditioning efficiency for use with a heat exchange system having a compressor , condenser , evaporator , expansion device , and circulating refrigerant .The apparatus includes is a liquid refrigerant containing vessel[1] having a refrigerant entrance and a refrigerant exit with a vessel positioned in the heat exchange system between the condenser and the evaporator , and means of creating a turbulent flow of liquefied refrigerant . The apparatus further preferably includes a refrigerant bypass path to sub cool a portion of the refrigerant with in the vessel; a disk positioned at the liquid refrigerant entrance to develop a low pressure are on the back side and create a turbulent flow of refrigerant entering the vessel; and a refrigerant valve incorporated into the refrigerant path down stream of expansion valve and before the coil which develops a vortex that continues through the refrigerant coil.

***Index Terms* –[1]refrigerant holding tank**

I. INTRODUCTION

It can be defined as the process of transferring heat from a low temperature region to a high temperature region. In other words it is the process of cooling a substance. This can be achieved only if the heat is removed from that substance.

Refrigeration is most widely used for air- conditioning of private homes and public buildings, and refrigerating foodstuffs in homes, restaurants and large storage warehouses. In industries it is used to liquefy gases like oxygen, nitrogen, propane and methane etc. Dairy products are constantly in need of refrigeration. It also helps in preserving fruits and vegetables to make them edible for longer time.
Domestic Refrigerators are one of the biggest contributors of typical residential electricity consumption; about 15% of the electrical consumption is by the Refrigerators. Hence efficiently operating the same can significantly impact the electricity bill. This project work aims at reducing the power consumption and improving the COP of the VCR

A refrigerant is a substance or mixture, usually a fluid, used in a heat pump and refrigeration cycle. In most cycles it undergoes phase transitions from a liquid to a gas and back again. Many working fluids have been used for such purposes. Fluorocarbons, especially chlorofluorocarbons, became commonplace in the 20th century, but they are being phased out because of their ozone depletion effects. Other common refrigerants used in various applications are ammonia, sulfur dioxide, and non-halogenated hydrocarbons such as propane etc.

Our project has been carried out by using a refrigerant which has zero ozone depletion potential and it belong to HFC group of refrigerants.

R134a is also known as Tetra-fluoro-ethane (CF_3CH_2F) from the family of HFC refrigerant. With the discovery of the damaging effect of CFCs and HCFCs refrigerants to the ozone layer, the HFC family of refrigerant has been widely used as their replacement.

It is now being used as a replacement for R-12 CFC refrigerant in the area of centrifugal, rotary screw, scroll and reciprocating compressors. It is safe for normal handling as it is non-toxic, non-flammable and non-corrosive. It exists in gas form when expose to the environment as the boiling temperature is -14.9°F or -26.1°C.

This refrigerant is not 100% compatible with the lubricants and mineral-based refrigerant currently used in R-12. Design changes to the condenser and evaporator need to be done to use this refrigerant. The use of smaller hoses and 30% increase in control pressure regulations also have to be done to the system.

II. TECHNICAL FIELD

The present invention relates generally to refrigeration and air conditioning, and particularly to an improved method and apparatus for improving refrigeration and air conditioning efficiency. More specifically, by relying on principles of fluid mechanics and turbulent flow of a refrigerant, the inventive apparatus achieves maximum refrigerant operational conditions while reducing energy consumption by the system.

III. DESIGN OF APPARATUS

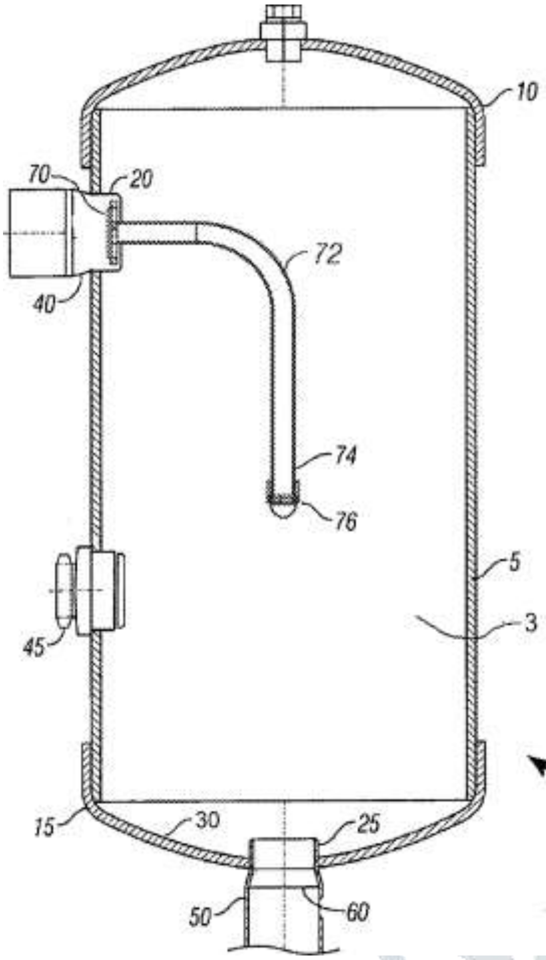

FIG : 1

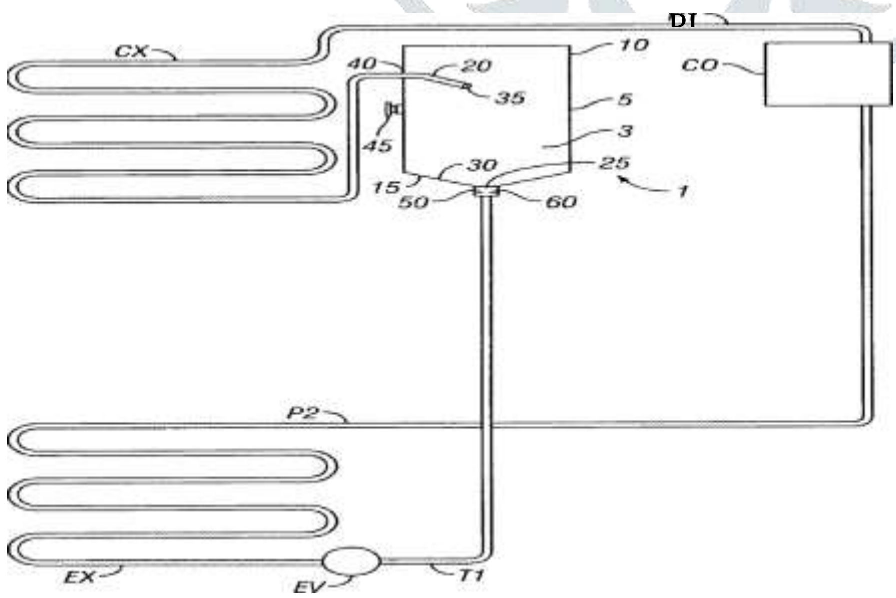

FIG : 2

IV. BACKGROUND IN FORMATION AND DISCUSSION OF RELATED ART

[0005]Various devices relying on standard refrigerant recycling technologies have been available [Or many years, such as refrigeration and heat pump devices, having both cooling and heating capabilities. Within the limits of each associated design specification, heat pump devices enable a user to cool or heat a selected environment or with a refrigeration unit to cool a desired location. For these heating and cooling duties, in general, gases or liquids are compressed, expanded, heated, or cooled within an essentially closed system to produce a desired temperature result in the selected environment.

[0006]Traditional sub-coolers partially cool the refrigerant prior to the expansion device and subsequent evaporator. Such refrigerant cooling has been shown 10 increase the efficiency of the heat transfer within the evaporator. Various types of sub-coolers exist, but the most common (or cools the refrigerant by drawing in cooler liquid to surround the warmer refrigerant. [0007]U.S. Pat. No. 5,259,213 to applicant herein discloses a heat pump efficiency enhancer (Or use with a heal pump 10 increase cooling and healing efficiency, between an outdoor condenser and an indoor evaporator. A refrigerant receiver or sub-cooler is provided within the high pressure liquid refrigerant portion of the system, including atleast one high flow, low pressure release check valve having an internal control element with a refrigerant turbulence producing backside that serves as an incremental expansion device to cool, by incremental expansion, and heat, by turbulence, the high pressure liquid refrigerant.

[00071 U.S. Pat. No. 5,426,956 to applicant herein describes a refrigerant system efficiency amplifying apparatus for use with a heat exchange system having a compressor, condenser, evaporator, expansion device, and circulating refrigerant. The apparatus includes a liquid refrigerant containing vessel having a refrigerant entrance and a refrigerant exit with the vessel positioned in the heat exchange system between the condenser and the evaporator, and means associated with the vessel for creating a turbulent flow of liquefied refrigerant.

V. RESULTS AND CONCLUSION

The condensing temperature is the temperature at which the refrigerant gas will condense to a liquid, at a given pressure. Well known standard tables relate this data. In a traditional example, using R134a refrigerant, that pressure is 226 PSIG. This produces a condensing temperature of 110 degrees F. At 110 degrees F. each pound of liquid feron that passes into the evaporator will absorb 70.052 Btu' s. However, at 90 degrees F. each pound of feron will absorb 75.461 Btu. Thus, the lower the temperature of the liquid refrigerant entering the evaporator the greater its ability to absorb heat. Each degree that the liquid refrigerant is lowered increases the capacity of the system by about one-half percent.

Well known standard tables of data that relate the temperature of a liquid refrigerant to the power required to move Btu's per hour show that if the liquid refrigerant is at 120 degrees F., 0.98 hp will move 22873 Btu's per hour. If the liquid refrigerant is cooled to 60 degrees F only 0.2 hp is required to move 29563 Btu's per hour.

VI. ACKNOWLEDGEMENT

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VII. REFREANCES

1) Y.V.C. Rao (2003). An Introduction to Thermodynamics(2nd ed.). Universities Press. ISBN 978-81-7371-461-0
2) Saturated vapors and saturated liquids are vapors and liquids at their saturation temperature and saturation pressure.HELL YEAH PEOPLE A superheated vapor is at a temperature higher than the saturation temperature corresponding to its pressure.
3) Everything R-134aThe Natural Refrigerant R-134a, 2006–2012
4) Morkovin M. V., Reshotko E., Herbert T. 1994. "Transition in open flow systems—a reassessment". *Bull. Am. Phys. Soc.* 39:1882.