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Research Paper

A REVIEW OF LITERATURE ON THE DEVELOPMENT OF VAPOUR COMPRESSION REFRIGERATION CYCLE

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It will be possible only if heat is transferred from the low temperature region to a high temperature region. Obviously it is not possible in the natural manner because heat flows from high temperature to low temperature like fluid flows from high pressure to low pressure/ current flows from high voltage to low voltage/ gas flows from high concentration to the region of low concentration. It means in refrigeration one is trying to go against the natural process as well as against the second law of thermodynamics which states that heat cannot flow from low temperature region to a high temperature region without the use of an external agent. The external agent in refrigeration is the compressor which introduces the most common method of refrigeration. Various modifications since the start of the new century has reflected the tremendous change in the coefficient of performance vapour compression refrigeration systems. This paper gives the overview of important modifications in VCRS were gifted to society.

Keywords: Compressor, Concentration, Performance, Temperature

INTRODUCTION

The most commonly used method of cooling is with vapor-compression cycles, because it is fairly easy to construct a cooling device employing this method and the cost is low. In fact, conventional refrigerators use this method of cooling to keep your leftovers and drinks chilled! Air conditioners also employ a vapor-compression cycle to cool the ambient air temperature in a room.

Basically, vapor-compression refrigeration employs a heat engine run backwards, so heat energy is taken from a cold reservoir and deposited into a hot reservoir. By the Second Law of Thermodynamics, heat energy does not spontaneously transfer from a cold to a hot reservoir. In order to have heat transfer in that direction (and from hot to cold, as the system is naturally inclined to do), it is necessary to do work on the system.

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VAPOR COMPRESSION REFRIGERATION CYCLE

This refrigeration cycle is approximately a Rankine cycle run in reverse. A working fluid (often called the refrigerant) is pushed through the system and undergoes state changes (from liquid to gas and back). The latent heat of vaporization of the refrigerant is used to transfer large amounts of heat energy, and changes in pressure are used to control when the refrigerant expels or absorbs heat energy.

However, for a refrigeration cycle that has a hot reservoir at around room temperature (or a bit higher) and a cold reservoir that is desired to be at around 34°F, the boiling point of the refrigerant needs to be fairly low. Thus, various fluids have been identified as practical refrigerants. The most common include ammonia, Freon (and other chlorofluorocarbon refrigerants, aka CFCs), and HFC-134a (a non-toxic hydrofluorocarbon).

DEVELOPMENTS IN VCRS

A mechanistic model of a roof-top air conditioning unit was designed by Rossi and Braun (1999). In this model, the significance of real time simulation is underlined and a presentation of a smart automatic integration step sizing algorithm is made which strongly simulates start-up and on-off cycling. A fully finite-volume formulation of the mass and energy balances in heat exchangers is considered and used for the designing of the system-model. Start up measurements of a 3-ton roof top unit is used for presenting the validation.

A separated flow-model for an evaporator was developed by Jing Xia and his co-mates (1997). They studied the dynamics of the evaporator under variations of condensing temperature, compressing speed, expansion valve opening and secondary fluid conditions. Jackobsen and his Company observed the relative accuracies of assumption of homogenous flow and stip-flow patterns in the heat exchanger. They concluded that homogeneous flow model was an appropriate representation and it over-predicted the sensitivity of the evaporator. When the dynamics of refrigerant is concerned, they prefer the use of the slip-flow model. An exclusive focus was directed towards liquid chillers by Sevnsson. Phase-wise lumped parameter formulation in the heat exchangers has been used for construction of this model. The phase-wise lumped parameter formulation in the heat-exchangers is adequate and appropriate for study of dynamics of the system to load disturbances. Step changes in the condenser side water flow rates introduce these disturbances.

Wang and Wang (1999) presented a mechanistic, single stage and two-stage centrifugal chiller models. The first principles, that is, the momentum equation, the energy equation and the velocity triangles is the origin of development of detailed model of centrifugal compressor. The inlet guide vane or the pre-rotation vanes form of capacity control have also been incorporated and inculcated in the model. The heat exchangers are constructed and designed in a very simplified manner.

A simple physics depended dynamic model with a dynamic neural network model of a screw chiller system was designed and analyzed by Browne and Bansal. The screw compressors are designed in the form of steady state devices, which includes capacity control. Capacity control is present in the form of varying swept volume in response to error in chilled water temperature. The dynamics of the system are designed as lumped elements for heat exchanger material and water. A quasi-static treatment is given to the refrigerant in the heat-exchangers.

A simplified dynamic model of a liquid chiller was designed by Grace and Tassou (2000). This dynamic model of liquid chiller consists of a reciprocating compressor and shell-tube heat exchangers. The refrigerant flows in condensor's shell while refrigerant flows in evaporator's tube. The individualization, separation and solution of heat exchanger is similar to the one developed by Mac Arthur and Grald. The elaborate scheme is a thermostatic valve with a sensing bulb.

The expansion is designed in isenthalpic form. The superheat sensing bulb is elaborately designed. It supplies detailing for all the relevant heat transfer resistances and capacitances.

Sainney *et al.* (2001), have calculated the compression ratio of compressor for different compositional mixture of two refrigerants. They found an optimum composition at which compression ratio is minimum.

Ferreira *et al.* (2006) have investigated a twin screw oil free compressor which can be operated under dry conditions.

Satapathy *et al.* (2007) has studied about the concentration of Refrigerants. This was comparative study in accordance to thermo dynamic stability. They studied that the high concentration solution of R-22-E-181 has higher capacity and stability than R134a-E-181, because R22 has high columetric capacity.

Yari *et al.* (2011) has studied about the hybrid refrigeration cycle according to 1st and 2nd laws of thermo-dynamics; and calculated the COP of the system.

Garimella *et al.* (2011) has compared cascaded system with two stage vapor compression refrigeration system, and found that is cascanded system a very high COP stays up to a wide range of applications and, therefore, energy saving can also be done in this case.

Zheng and Meng (2012) have studied the thermo-dynamic mechanism of hybrid cycle and they plotted a graph for compression pressure and coefficient of performance of vapor compression refrigeration system.

CONCLUSION

Various modifications have been seen in last decades but invention of oil free compressor, that can work under the dry condition is the tremendous discovery . It is also observed that there are so many refrigerants which are used in VCRS, but the requirement of CFC free refrigerants is increasing day by day, in previous decade so many researches have been done in such areas. In similar series it was observed that the high concentration solution of R-22-E-181 has higher capacity and stability than R134a-E-181, give major modification in the refrigeration system.

Some other modifications and important invention that provide simplified dynamic model of a liquid chiller and study of the thermo-dynamic mechanism of hybrid cycle, study about the concentration of Refrigerants , investigation of a twin screw oil free compressor, dynamic neural network model so on support to give an optimized model of VCRS in all respects.

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